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ABSTRACT

This document, which reflects Mississippi's statutory requirement that instructional programs be based on core curricula and performance-based assessment, contains outlines of the instructional units required in local instructional management plans and daily lesson plans for small engine repair I and II. Presented first are a program description and course outlines. Section I contains curriculum frameworks for both courses, and section II contains outlines of the instructional units required in each course. Small Engine Repair I contains the following 11 units: safety and orientation; tools and equipment; fasteners; measurement; engine identification and inspection; basic engine principles and design; basic electricity; ignition systems; lubrication systems; cooling systems; and fuel systems (carburetor-type). The second-level course contains these 10 units: safety and orientation review; charging systems; governor systems; starting systems; exhaust systems; shop management; employability skills; overhaul of four-stroke and two-stroke cycle engines; and troubleshooting. Each unit includes suggested time on tasks, competencies and objectives, teaching strategies, assessment strategies, and resources. Recommended tools and equipment are listed in section III. Appended are lists of related academic topics and workplace skills for the 21st century and student competency profiles for both courses. (KC)

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ED 397 320

Mississippi Curriculum Framework for Small Engine Repair

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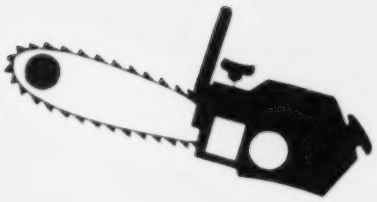

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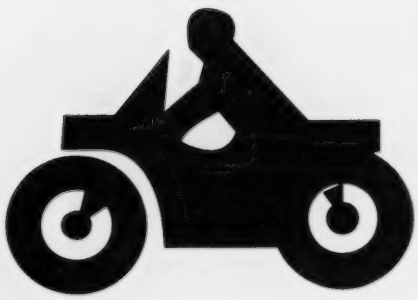

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1996

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July 30, 1996

MISSISSIPPI

CURRICULUM FRAMEWORK

FOR

SMALL ENGINE REPAIR

(Program CIP: 47.0606 - Small Engine Mechanic and Repairer)

SECONDARY PROGRAMS 1996

July 30, 1996

Direct inquiries to:

Program Coordinator
Trade and Technical Education
Office of Vocational and Technical Education
Mississippi Department of Education
P.O. Box 771
Jackson, MS 39205
(601) 359-3940

For copies of this publication, contact:

Research and Curriculum Unit
P.O. Drawer DX
Mississippi State, MS 39762
(601) 325-2510

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FOREWORD

The curriculum framework in this document reflects the work of teachers, state and local administrators, and representatives of business, industry, and service occupations to enhance the content of vocational-technical courses in Mississippi public schools. Revision of the curriculum was begun by a team of teachers from the program area. The resulting draft was submitted to local administrators for review and comments, and to a Standing Technical Committee composed of employers and employees in the occupational area(s) of the curriculum. Comments and recommendations from these reviews were presented to the revision team for discussion and action. An executive summary of this document, containing the program and course descriptions and competencies and suggested objectives for each course, was presented to the Mississippi Board of Education for formal approval and adoption.

The intent of this document is to provide local school district personnel with a framework which can be used to develop local instructional management plans and lesson plans for teaching vocational-technical courses. The contents of this framework are not intended to limit the selection of the actual competencies and objectives in the course, but instead to provide a minimum baseline which all schools must meet. Teachers and curriculum development personnel are encouraged to expand and enhance this framework to meet the needs of their students.

The courses in this document reflect the following statutory requirements as found in Section 37-3-49, Mississippi Code of 1972, as amended:

> The State Department of Education shall provide an instructional program and establish guidelines and procedures for managing such programs in the public schools as part of the State Program of Educational Accountability and Assessment of Performance. . .
>
> The department shall provide that such program or guidelines . . . are enforced through the performance-based accreditation system.
>
> The local school board must adopt the objectives that will form the core curriculum that will be systematically delivered throughout the district.
>
> Standards for student performance must be established for each core objective in the local program and those standards establish the district's definition of mastery for each objective.
>
> There shall be an annual review of student performance in the instructional program against locally established standards.

Each secondary vocational-technical course consists of a series of instructional units which focus on a common theme. All units have been written using a common format which includes the following components:

- Unit Number and Title
- Suggested Time on Task - The number of days of instruction that should be required to teach the competencies and objectives of the unit. For secondary occupational programs, a "day" represents a two-period block of instruction.
- Competencies and Suggested Objectives
  - A **Competency** represents a general concept of performance that students are expected to master as a requirement for satisfactorily completing a unit. Students will be expected to master all competencies in the curriculum framework in order to satisfactorily complete the course.
  - The **Suggested Objectives** represent the enabling and supporting knowledge and performances that will indicate mastery of the competency.
- Suggested Teaching Strategies - This section of each unit indicates strategies that can be used to enable students to master each suggested objective. Teachers should feel free to modify or enhance these suggestions based on needs of their students and resources available in order to provide optimum learning experiences for their students.
- Suggested Assessment Strategies - This section indicates strategies that can be used to measure student mastery. Examples of suggested strategies could include classroom discussions, laboratory exercises, and student assignments. Again, teachers should feel free to modify or enhance these suggested assessment strategies based on local needs and resources.
- Suggested Resources - This section indicates some of the primary instructional resources that may be used to teach the competencies and suggested objectives. Again, these resources are suggested and the list may be modified or enhanced based on needs and abilities of students and on available resources.

The following guidelines were used in developing the curriculum framework in this document and should be considered in developing local instructional management plans and daily lesson plans:

- The content of the courses in this document reflects approximately 75 percent of the time allocated to each course. For a one-year course, this means that the content of the existing units of instruction should represent approximately 135 days of instruction. The remaining 25 percent of each course should be developed at the local district level and may reflect:
  - Additional units of instruction within the course related to topics not found in the state framework.
  - Activities which develop a higher level of mastery on the existing competencies and suggested objectives.
  - Activities and instruction related to new technologies and concepts that were not prevalent at the time the current framework was developed/revised.
  - Activities which implement components of the Mississippi Tech Prep Initiative, including integration of academic and vocational-technical skills and coursework, school-to-career transition activities, and articulation of secondary and postsecondary vocational-technical programs.
  - Individualized learning activities, including work site learning activities, to better prepare individuals in the courses for their chosen occupational area.
- Sequencing of the units of instruction within a course is left to the discretion of the local district. Naturally, foundation units related to topics such as safety, tool and equipment usage, and other fundamental skills should be taught first. Other units related to specific skill areas in the course, however, may be sequenced to take advantage of seasonal and climatic conditions, resources located outside of the school, and other factors.

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Writing Team

Cleoptha Davis, Quitman County Vocational Center, Marks
George Britt, Career Development Center, Jackson
Jimmy Carter, West Tallahatchie High School, Webb
Jimmy Evans, Ross Collins Vocational Center, Meridian
Walter Reynolds, Jefferson County Vocational Center, Fayette

Team Leader

Vanik S. Eaddy, Ph.D., Research and Curriculum Specialist

OVTE Staff

John White, Program Coordinator, Trade and Technical Education

Reviewers

Practitioners:
Sara C. McKinney
John H. Munn
David L. Perry

Educators:
Seoye Britt
Walter D. Reynolds
Silby Roberts

Technical Committee

Sam Cobbins
Larry Crimm
Dearld Dear
John DeVoe
Grady Edwards
Don Gillespie
James Ivy
Ken Riley
Lin Rodgers
Joseph Simon
L.W. Smith
Fred Strohm
Jack Wynne

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PROGRAM DESCRIPTION

SMALL ENGINE REPAIR

(CIP: 47.0606 - Small Engine Mechanic and Repairer)

Small Engine Repair is an instructional program that generally prepares individuals to repair small internal-combustion engines used on portable power equipment such as lawn mowers, chain saws, rotary tillers, motorcycles, and lawn and garden tractors. Students in Small Engine Repair I complete study in safety, tools and equipment, fasteners, measuring, engine identification and inspection, basic engine principles and design, lubrication systems, cooling systems, fuel systems, governor systems, and shop management. Students in Small Engine Repair II complete study in safety, basic electricity, ignition systems, charging systems, starting systems, exhaust systems, overhaul of four-stroke and two-stroke cycle engines, and troubleshooting.

COURSE OUTLINE

SMALL ENGINE REPAIR I

Unit No.	Unit Title	No. of Days
Unit 1	Safety and Orientation	5
Unit 2	Tools and Equipment	10
Unit 3	Fasteners	5
Unit 4	Measurement	15
Unit 5	Engine Identification and Inspection	15
Unit 6	Basic Engine Principles and Design	15
Unit 7	Basic Electricity	15
Unit 8	Ignition Systems	10
Unit 9	Lubrication Systems	15
Unit 10	Cooling Systems	15
Unit 11	Fuel Systems (Carburetor-Type)	15

SMALL ENGINE REPAIR II

Unit No.	Unit Title	No. of Days
Unit 1	Safety and Orientation (Review and Reinforcement)	5
Unit 2	Charging Systems	10
Unit 3	Governor Systems	10
Unit 4	Starting Systems	10
Unit 5	Exhaust Systems	10
Unit 6	Shop Management	10
Unit 7	Employability Skills	15
Unit 8	Overhaul of Four-Stroke Cycle Engine	20
Unit 9	Overhaul of Two-Stroke Cycle Engine	20
Unit 10	Troubleshooting	25

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SECTION I:

CURRICULUM FRAMEWORK

FOR

SMALL ENGINE REPAIR

CURRICULUM FRAMEWORK

Course Name: Small Engine Repair I

Course CIP Code: 47.0606

Course Description: Small Engine Repair I is an instructional program that generally prepares individuals to repair small internal-combustion engines used on portable power equipment such as lawn mowers, chain saws, rotary tillers, motorcycles, and lawn and garden tractors. Students in Small Engine Repair I complete study in safety, tools and equipment, fasteners, measuring, engine identification and inspection, basic engine principles and design, lubrication systems, cooling systems, fuel systems, governor systems, and shop management. (2-2½ Carnegie Units, depending upon time spent in the course)

Competencies and Suggested Objectives:

1. Explain vocational policies, procedures, and requirements.
   a. Describe grading procedures used in the school.
   b. Describe vocational policies.
   c. Describe school attendance policies.
   d. Describe the student handbook.

   Related Academic Topics (See Appendix A): C1, C3, C5
   Workplace Skills (See Appendix B): WP1, WP2
2. Apply safety laws and standards used in small engine repair.
   a. Describe state eye safety law, including appropriate times for wearing safety glasses.
   b. Define terms associated with safety including accident, safety, first aid, hazardous materials, and OSHA.
   c. Associate the colors of the safety code with their correct application including red, green, yellow, black, white, orange, and blue.
   d. Describe rules for personal and general shop safety related to small engine repair including hygiene, clothing, avoidance of horseplay, shop housekeeping, ventilation, safety equipment, location of fire safety and first aid equipment, shop layout, lifting and hoisting devices, vehicles, flammable liquids, hazardous materials, and pertinent safety codes.

   Related Academic Topics (See Appendix A): C1, C3, C4, C5
   Workplace Skills (See Appendix B): WP1, WP2, WP4
3. Explain procedures for working with and disposing of hazardous materials according to OSHA regulations.
   a. Define terms associated with hazardous materials including carcinogens, batteries, acids, flammables, and radioactive materials.

b. Identify categories of hazardous materials including exhaust fumes, solvents and degreasers, antifreeze and hydraulic fluids, fuels and lubricants, metal fumes and dust, asbestos, and battery acid.
c. Identify signal words or symbols that indicate the severity of a hazard including "Caution" used in conjunction with a skull and crossbones (less severe), "Warning" used in conjunction with poison or skull and crossbones (severe), and "Danger" used in conjunction with poison or skull and crossbones (most severe).
d. Describe methods for reducing hazardous waste including: (1) substitute non-hazardous materials, (2) recycle waste, (3) re-use product, (4) use only amount of product needed, and (5) avoid stockpiling.
e. Identify general procedures for storing hazardous materials and wastes including the following: (1) make sure that all containers are properly labeled at all times, (2) mark all containers containing hazardous waste materials with the words **"HAZARDOUS WASTE"** and with the date that the container was first used to store the waste, (3) store wastes and materials as described by the manufacturer, (4) make sure that containers are intact and secure at all times, and (5) keep all containers secured except when being filled or emptied.
f. Identify and describe the informational sections found on a Material Safety Data Sheet which provide guidelines for creating a safe work environment.
g. Describe general first aid procedures in case of an accident involving hazardous materials: (1) move the victim to fresh air; (2) check the container label, Material Safety Data Sheet, or other source for first aid procedures and begin first aid at once; (3) contact the person designated to help with first aid and evacuation procedures; (4) call an ambulance; (5) follow instructions from the designated person concerning further first aid and evacuation measures; (6) remain with the person until the ambulance arrives; and (7) attach a Material Safety Data Sheet or other information on the material to the person's clothing prior to transport.
h. Identify safety equipment to be used with hazardous materials including protection for eyes, respiratory system, body, and hands.
i. Describe steps to follow in handling spills and waste disposal including: (1) evacuate the area, (2) read container label, (3) call fire department (if flammable), (4) call manufacturer for clean-up instructions, (5) check FRS Manual, (6) use proper protection equipment, and (7) contain the flow of waste.
j. Identify agencies to be contacted in case of an accident or for more information on hazardous materials including National Response Center, EPA Regional Office, and Mississippi Department of Natural Resources.

Related Academic Topics (See Appendix A): C1, C3, C4, C5, S4, S5, S8
Workplace Skills (See Appendix B): WP1, WP2, WP4

4. Explain the application and use of hand tools.
   a. Identify basic hand tools needed for maintenance and repair of small engines including screwdrivers, hammers, punches, chisels, and files.
   b. Identify the tools used in overhaul of small engines including special tools, flywheel pullers, ring contractor, valve spring compressors, cylinder hone, ring expander, micrometer, and thickness gauge.
   c. Identify the types of torque wrenches including direct reading, dial, and signaling.
   d. Describe procedures concerning the maintenance of hand tools including re-grinding worn or damaged flat blade screwdrivers, discarding Phillips screwdrivers with damaged heads, keeping pliers clean and rust free, keeping cutting edges sharp and smooth, keeping ratchets clean and well lubricated, and marking all tools with engraving tool.

   Related Academic Topics (See Appendix A): C3, S8
   Workplace Skills (See Appendix B): WP1, WP2, WP4
5. Explain the safe use of power tools and equipment.
   a. Describe the safe use of pneumatic tools.
   b. Service and use an air compressor.
   c. Describe the safe use of electrical drills.
   d. Describe the safe use of bench grinders and portable grinders.
   e. Demonstrate the use of computer equipment and software for parts identification and estimation of repair costs in Small Engine Repair.

   Related Academic Topics (See Appendix A): C3, S8
   Workplace Skills (See Appendix B): WP1, WP2, WP4
6. Explain common fasteners, tools, and procedures for restoring damaged threads.
   a. Identify common fasteners including typical nuts, bolts, special purpose nuts with locking features, devices for locking nuts or bolts, designs of screw heads, and snap rings.
   b. Identify methods used to remove seized nuts including penetrating oil, chisel, gas torch, and hacksaw.
   c. Identify tools used to restore internal and external threads including re-threading tool, tap and die, thread restorers, and internal threading.
   d. Restore internal threads using a thread insert kit (Helicoil) according to manufacturer's specifications.
   e. Utilize torque wrenches to tighten bolts/nuts to manufacturer's specifications.

   Related Academic Topics (See Appendix A): C1, C2, C3, S8
   Workplace Skills (See Appendix B): WP1, WP2, WP6
7. Apply measurement procedures used in small engine repair.
   a. Identify measuring instruments used in small engine repair including vernier caliper, feeler gauge, dial indicator, and steel rule.
   b. Use a plain micrometer to measure a given object to within ±.001 inch.

c. Use a vernier caliper to measure a given object to within ±.001 inch.
d. Use a 6" rule to measure a given object within 1/16".

Related Academic Topics (See Appendix A): C1, C2, C4, M4, M7
Workplace Skills (See Appendix B): WP2, WP4, WP5

8. Identify types of small engines.
   a. Define new terms associated with engine identification and inspection including combustion, chamber, crankcase, cycle, two-stroke, and four-stroke.
   b. Describe distinguishing characteristics of four-stroke and two-stroke cycle engines: (1) four-stroke cycle engine usually has an oil sump and possibly an oil filter, exhaust muffler connects at the head of the engine cylinder, and compression resistance is felt every other revolution and (2) two-stroke cycle engine does not have an oil sump or oil filter, the exhaust port is about midpoint on the cylinder, and compression resistance is felt every revolution.
   c. Describe categories of information which can be determined from the operator's instructions and/or inspection of the engine including general information, name and address of manufacturer, operating position of crankshaft, service and maintenance specifications, type of engine (two- or four-stroke), and operating position.
   d. Complete an engine identification and inspection form according to manufacturer's specifications.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C6
   Workplace Skills (See Appendix B): WP1, WP2, WP4, WP5

9. Explain the principles of operation of an internal combustion engine.
   a. Define terms associated with basic engine principles and design including parts of the basic internal combustion engine, forms of available energy, types of motion, types of energy, and types of engine design.
   b. Describe the parts of a basic internal combustion engine cylinder unit including cylinder, piston, rings, connecting rod, crankshaft, camshaft, and intake and exhaust valves.
   c. Describe steps in the process by which an internal combustion engine converts chemical energy into rotary motion: (1) gasoline and air are introduced into the upper end of the cylinder, (2) heat energy causes the cylinder gases to expand, (3) expansion of burning gases pushes piston down the cylinder, and (4) downward motion of the piston transmits force to the crankshaft through the connecting rod to create rotary motion.

   Related Academic Topics (See Appendix A): C1, C2, C4, S5, S6, S8
   Workplace Skills (See Appendix B): WP1, WP2, WP4

10. Analyze engine horsepower rating.
    a. Read and interpret engine label.

b. Read and interpret manufacturer's service manual to analyze engine horsepower rating.

Related Academic Topics (See Appendix A): C1, C2, M4, M7, S5, S6, S8
Workplace Skills (See Appendix B): WP1, WP2, WP4

11. Explain the principles of four-stroke cycle engine operation.
    a. Define terms associated with the principles of operation of a four-stroke cycle engine including intake stroke, compression stroke, power stroke, exhaust stoke, intake and exhaust valve overlap, camshaft, and valve spring.
    b. Identify basic components of a four-stroke cycle engine including cylinder block, cylinder head, piston, connecting rod, crankshaft, camshaft, valves, and valve spring.
    c. Describe the operation of a four-stroke cycle engine as related to each stroke of the cycle: (1) intake stroke - upward motion of piston which permits fuel-air mixture to enter cylinder via open intake valve, (2) compression stroke - upward movement of piston which compresses fuel-air mixture with both valves closed, (3) power stroke - downward piston movement caused by spark ignition of compressed fuel-air mixture, and (4) exhaust stroke - upward piston movement which expels burned gases from cylinder.

    Related Academic Topics (See Appendix A): C1, C2, C4, M4, M7, S5, S6, S8
    Workplace Skills (See Appendix B): WP1, WP2, WP4, WP6
12. Explain the principles of two-stroke cycle engine operation.
    a. Define terms associated with the two-stroke cycle engine including expansion chamber, reed valve, rotary valve, exhaust port, intake port, and transfer.
    b. Identify basic components of a two-stroke cycle engine including cylinder, piston, connecting rod, crankcase, and crankshaft.
    c. Describe the steps in the operation of a two-stroke cycle: (1) piston moves up in cylinder drawing fuel-air mixture into crankcase, (2) piston moves down cylinder pressurizing mixture in crankcase, (3) piston moves past transfer port allowing pressurized mixture to move into combustion chamber, and (4) sparkplug fires compress mixture causing piston to move up cylinder closing both transfer and exhaust ports and producing rotary motion of crankshaft.

    Related Academic Topics (See Appendix A): C1, C2, C4, M4, M7, S5, S6, S8
    Workplace Skills (See Appendix B): WP1, WP2, WP4, WP6
13. Explain the principles of basic electricity.
    a. Define terms associated with basic electricity including ampere, ohm, resistance, voltage, current, conductor, insulator, and circuit.
    b. Describe sources of electricity including chemical and magnetic.
    c. Identify examples of conductors and insulators of electricity including conductors (copper, aluminum, and steel) and insulators (glass, rubber, ceramic, and plastic).

d. Identify common electrical symbols used in schematic diagrams including battery, ground, solenoid, coil, resistance or load, connection, switch, terminal, and fuse.

Related Academic Topics (See Appendix A): C1, C3, C4, C6, M7, S6, S8
Workplace Skills (See Appendix B): WP2, WP4, WP5, WP6

14. Describe instruments and perform measurements of electricity.
    a. Describe instruments used in checking electrical circuits including ammeter, voltmeter, and ohmmeter.
    b. Measure resistance using an ohmmeter in parallel and closed circuits.
    c. Check continuity of a simple circuit using an ohmmeter or test light.
    d. Measure amperage in a circuit using an ammeter.
    e. Check voltage in a circuit using a voltmeter.

    Related Academic Topics (See Appendix A): C1, C2, C3, C4, C6, M7, S6, S8
    Workplace Skills (See Appendix B): WP2, WP4, WP5, WP6
15. Explain the components of a small engine ignition system.
    a. Describe the types of ignition systems including battery, magneto, and solid state.
    b. Identify components of a battery ignition system (primary and secondary circuits) including battery, ignition switch, primary winding, contact points, condenser, low voltage wire, secondary winding, rotor, and spark plug.
    c. Identify components of a magneto ignition system (primary and secondary systems) including flywheel with magnets, armature, switch stop, coil, contact points, condenser, spark plug, and high voltage wire.
    d. Identify components of a solid state ignition system including flywheel with magnets, trigger coil, transistorized rectifier, diode rectifier, and ignition coil.
    e. Identify components of a breaker-less ignition system including battery flywheel, trigger module, ignition switch, alternator, stator, ignition coil assembly, and rectifier-regulator.
    f. Describe the purpose of ignition system components including battery, ignition switch, coil, contact points, condenser, breaker cam, diode rectifier, trigger coil, and spark plug.
    g. Describe the operation of ignition systems including battery, magneto, and solid state.

    Related Academic Topics (See Appendix A): C1, C2, C3, C4, C6, M7, S6, S8
    Workplace Skills (See Appendix B): WP2, WP4, WP5, WP6
16. Service and test small engine ignition systems.
    a. Remove, service, and/or replace spark plugs according to manufacturer's specifications.
    b. Remove and replace contact points and condenser according to manufacturer's specifications.
    c. Test the coil, condenser, armature, and flywheel magnets according to manufacturer's specifications.

d. Test and adjust a solid state ignition system according to manufacturer's specifications.
e. Perform a coil power test according to manufacturer's specifications.
f. Test condenser for leakage or short according to manufacturer's specifications.

Related Academic Topics (See Appendix A): C1, C2, C3, C4, C6, M7, S6, S8
Workplace Skills (See Appendix B): WP2, WP4, WP5, WP6

17. Explain the principles of lubrication and engine oils.
    a. Define terms related to lubrication systems including types of lubrication systems, functions of engine oil, characteristics of good engine oil, and Society of Automotive Excellence (SAE) viscosity number.
    b. Describe the functions of engine oil including reducing friction and wear, keeping parts clean, cooling moving parts, and cushioning moving parts.
    c. Describe the characteristics of an appropriate engine oil including provides a protective film on moving parts, resists breakdown at high temperatures, resists corrosion and rusting, prevents carbon buildup, prevents sludge formation, and flows easily at low temperatures.
    d. Describe factors to consider in selection and use of oils for best engine performance including selection of brands which meet engine manufacturer's specifications, draining and changing at recommended intervals, selecting oils which have been performance tested, and never mixing oils of various specifications.

    Related Academic Topics (See Appendix A): C1, C2, C4, C6, S5, S8
    Workplace Skills (See Appendix B): WP1, WP2, WP4, WP6
18. Perform lubrication services on small engines.
    a. Change engine oil and filter (if present) including replacement or cleaning of oil filter according to manufacturer's specifications.
    b. Service a crankcase breather according to manufacturer's specifications.
    c. Mix lubricant and fuel for a two-stroke cycle engine according to manufacturer's specifications.

    Related Academic Topics (See Appendix A): C1, C2, C4, C6, M7, S5, S8
    Workplace Skills (See Appendix B): WP1, WP2, WP4, WP6
19. Apply procedures for preparing a small engine for storage.
    a. Prepare a small engine for storage according to manufacturer's specifications.

    Related Academic Topics (See Appendix A): C1, C2, C4, C6, S5, S8
    Workplace Skills (See Appendix B): WP1, WP2, WP4, WP6
20. Service an air-cooled small engine system.
    a. Define terms associated with air-cooled cooling systems including conduction, convection, air-cooled system, liquid-cooled system, and cooling fin.
    b. Identify components of an air-cooled engine cooling system including flywheel, filter screen, blower shroud, air deflector, and cylinder baffle.

c. Remove, clean, and replace air cooling system parts according to manufacturer's specifications.

Related Academic Topics (See Appendix A): C1, C2, C3, C6, S8
Workplace Skills (See Appendix B): WP1, WP2, WP5, WP6

21. Service a water-cooled small engine system.
    a. Identify the parts of a water-cooled engine cooling system including radiator, upper and lower radiator hose, thermostat housing, thermostat, and water pump.
    b. Inspect and service a water-cooled engine cooling system including checking the radiator for leaks, checking the hoses, draining and flushing the system, checking the thermostat, checking the radiator cap, and refilling the system with antifreeze mixture according to manufacturer's specifications.

    Related Academic Topics (See Appendix A): C1, C2, C3, C6, M7, S8
    Workplace Skills (See Appendix B): WP1, WP2, WP5, WP6
22. Identify fuel and fuel systems used in small engines.
    a. Describe benefits of using unleaded fuel in most new small gas engines including lower exhaust emissions and less carbon accumulation.
    b. Identify the components of a typical carburetor-type fuel system including fuel tank, fuel filter, carburetor, fuel pump, fuel line, and air cleaner.
    c. Identify the different types of fuel filters including in-line, screen in fuel tank, and glass sediment bowl with screen.
    d. Identify the different types of air cleaners including oil bath, paper element, and polyurethane.
    e. Identify the parts of a float-type carburetor including float needle, fuel inlet, float needle seat, float, needle valve, choke valve, and venturi.
    f. Identify the parts of a diaphragm-type carburetor including diaphragm, idle adjusting screw, needle valve, spring and cap, choke, and fuel pipes.
    g. Describe functions of the carburetor to include vaporizing of gasoline, choke system, primer system, high speed adjustment, and idle speed adjustment.

    Related Academic Topics (See Appendix A): C1, C2, C3, C6
    Workplace Skills (See Appendix B): WP1, WP2, WP4, WP5, WP6
23. Remove, service, replace, and adjust an air cleaner, oil bath cleaner, float-type carburetor, and diaphragm-type carburetor.
    a. Service an air cleaner (paper element and polyurethane) according to manufacturer's specifications.
    b. Service an oil bath air cleaner according to manufacturer's specifications.
    c. Remove, service, replace, and adjust a float-type carburetor according to manufacturer's specifications.
    d. Remove, service, replace, and adjust a diaphragm-type carburetor according to manufacturer's specifications.

    Related Academic Topics (See Appendix A): C1, C2, C3, C6
    Workplace Skills (See Appendix B): WP1, WP2, WP4, WP5, WP6

CURRICULUM FRAMEWORK

Course Name: Small Engine Repair II

Course CIP Code: 47.0613

Course Description: Small Engine Repair is an instructional program that generally prepares individuals to repair small internal-combustion engines used on portable power equipment such as lawn mowers, chain saws, rotary tillers, motorcycles, and lawn and garden tractors. Students in Small Engine Repair II complete study in safety, basic electricity, ignition systems, charging systems, starting systems, exhaust systems, overhaul of four-stroke and two-stroke cycle engines, and troubleshooting. (2-2½ Carnegie Units, depending upon time spent in the course)

Competencies and Suggested Objectives:

1. Explain vocational policies, procedures, and requirements.
   a. Describe grading procedures used in the school.
   b. Describe vocational policies.
   c. Describe school attendance policies.
   d. Describe the student handbook.

   Related Academic Topics (See Appendix A): C1, C3, C5
   Workplace Skills (See Appendix B): WP1, WP2
2. Apply safety laws and standards used in small engine repair.
   a. Describe state eye safety law, including appropriate times for wearing safety glasses.
   b. Define terms associated with safety including accident, safety, first aid, hazardous materials, and OSHA.
   c. Associate the colors of the safety code with their correct application including red, green, yellow, black, white, orange, and blue.
   d. Describe rules for personal and general shop safety related to small engine repair including hygiene, clothing, avoidance of horseplay, shop housekeeping, ventilation, safety equipment, location of fire safety and first aid equipment, shop layout, lifting and hoisting devices, vehicles, flammable liquids, hazardous materials, and pertinent safety codes.

   Related Academic Topics (See Appendix A): C1, C3, C4, C5
   Workplace Skills (See Appendix B): WP1, WP2, WP4
3. Explain procedures for working with and disposing of hazardous materials according to OSHA regulations.
   a. Define terms associated with hazardous materials including carcinogens, batteries, acids, flammables, and radioactive materials.
   b. Identify categories of hazardous materials including exhaust fumes, solvents and degreasers, antifreeze and hydraulic fluids, fuels and lubricants, metal fumes and dust, asbestos, and battery acid.

c. Identify signal words or symbols that indicate the severity of a hazard including "Caution" used in conjunction with a skull and crossbones (less severe), "Warning" used in conjunction with poison or skull and crossbones (severe), and "Danger" used in conjunction with poison or skull and crossbones (most severe).
d. Describe methods for reducing hazardous waste including: (1) substitute non-hazardous materials, (2) recycle waste, (3) re-use product, (4) use only amount of product needed, and (5) avoid stockpiling.
e. Identify general procedures for storing hazardous materials and wastes including the following: (1) make sure that all containers are properly labeled at all times, (2) mark all containers containing hazardous waste materials with the words **"HAZARDOUS WASTE"** and with the date that the container was first used to store the waste, (3) store wastes and materials as described by the manufacturer, (4) make sure that containers are intact and secure at all times, and (5) keep all containers secured except when being filled or emptied.
f. Identify and describe the informational sections found on a Material Safety Data Sheet which provide guidelines for creating a safe work environment.
g. Describe general first aid procedures in case of an accident involving hazardous materials: (1) move the victim to fresh air; (2) check the container label, Material Safety Data Sheet, or other source for first aid procedures and begin first aid at once; (3) contact the person designated to help with first aid and evacuation procedures; (4) call an ambulance; (5) follow instructions from the designated person concerning further first aid and evacuation measures; (6) remain with the person until the ambulance arrives; and (7) attach a Material Safety Data Sheet or other information on the material to the person's clothing prior to transport.
h. Identify safety equipment to be used with hazardous materials including protection for eyes, respiratory system, body, and hands.
i. Describe steps to follow in handling spills and waste disposal including: (1) evacuate the area, (2) read container label, (3) call fire department (if flammable), (4) call manufacturer for clean-up instructions, (5) check FRS Manual, (6) use proper protection equipment, and (7) contain the flow of waste.
j. Identify agencies to be contacted in case of an accident or for more information on hazardous materials including National Response Center, EPA Regional Office, and Mississippi Department of Natural Resources.

Related Academic Topics (See Appendix A): C1, C3, C4, C5, S4, S5, S8
Workplace Skills (See Appendix B): WP1, WP2, WP4

4. Explain the components of small engine charging systems.
   a. Identify components of the charging system and state the function(s) of each, including generator or alternator, regulator, and ammeter.

b. Identify the parts of an alternator charging system including alternator coil or stator, flywheel, rectifier, and battery.

Related Academic Topics (See Appendix A): C1, C2, C3, C4, C6, M7, S6, S8
Workplace Skills (See Appendix B): WP2, WP4, WP5, WP6

5. Service a small engine charging system.
   a. Remove, check, and replace an alternator according to manufacturer's specifications.

Related Academic Topics (See Appendix A): C1, C2, C3, C4, C6, M7, S6, S8
Workplace Skills (See Appendix B): WP2, WP4, WP5, WP6

6. Explain governor systems used in small engines.
   a. Describe purposes of the governor system including maintenance of selected speed, prevention of over-speeding that may cause engine damage, and limiting high and low speeds.
   b. Identify components of an air vane governor system and state the purpose of each including air vane, throttle linkage, flywheel, and control spring.
   c. Identify components of a mechanical governor system and state the purpose of each including throttle control, throttle rod, throttle linkage, control spring, and flyweights.

Related Academic Topics (See Appendix A): C1, C2, C3, C4, C6
Workplace Skills (See Appendix B): WP2, WP4, WP5, WP6

7. Inspect, adjust, and repair small engine governor systems.
   a. Inspect, adjust, and repair an air vane governor according to manufacturer's specifications.
   b. Inspect, adjust, and repair a mechanical governor with internal flyweights according to manufacturer's specifications.
   c. Service small engine controls according to manufacturer's specifications.

Related Academic Topics (See Appendix A): C1, C2, C3, C4, C6
Workplace Skills (See Appendix B): WP2, WP4, WP5, WP6

8. Explain the components of small engine starting systems.
   a. Describe the types of starting systems including rope wind, rope recoil, and electric (AC and DC).
   b. Identify the components of a mechanical starting system and state the function of each including starter housing, recoil spring, pulley, and engaging pawl or dog.
   c. Identify the components of a DC starting system and state the function of each including battery, key switch, starter motor, switch wire, and battery cables.

Related Academic Topics (See Appendix A): C1, C2, C3, C4, C6, M7, S6, S8
Workplace Skills (See Appendix B): WP2, WP4, WP5, WP6

9. Test/service small engine starting systems.
   a. Remove, test/service, and replace a DC starter according to manufacturer's specifications.

b. Replace a starter rewind spring according to manufacturer's specifications.
c. Service the vertical pull starter according to manufacturer's specifications.

Related Academic Topics (See Appendix A): C1, C2, C3, C4, C6, M7, S6, S8
Workplace Skills (See Appendix B): WP2, WP4, WP5, WP6

10. Explain the functions of small engine exhaust systems.
    a. Define terms associated with exhaust systems including exhaust valve, exhaust pipe, muffler, tail pipe, and exhaust port.
    b. Describe results that can occur from running a damaged or worn exhaust system including loss of power and ring and valve damage.

    Related Academic Topics (See Appendix A): C1, C2, C3, C4, C6, S6, S8
    Workplace Skills (See Appendix B): WP2, WP4, WP5, WP6
11. Service the muffler system on two- and four-stroke cycle engines.
    a. Remove carbon deposits from exhaust ports and muffler of a two-stroke cycle engine according to manufacturer's specifications.
    b. Replace a muffler on a small engine according to manufacturer's specifications.

    Related Academic Topics (See Appendix A): C1, C2, C3, C4, C6, S6, S8
    Workplace Skills (See Appendix B): WP2, WP4, WP5, WP6
12. Apply principles of customer relations in the small engine repair shop.
    a. Communicate with customer and/or supervisor to determine service requested including interpreting and applying oral and written communications.
    b. Complete customer work order form including using the manufacturer's parts manual and the standard work order form to request parts for the engine being repaired and make a formal record to provide accountability of parts used.

    Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M7
    Workplace Skills (See Appendix B): WP1, WP2, WP3, WP4, WP6
13. Apply procedures of shop management in the small engine repair shop.
    a. Utilize parts identification media including parts manuals, microfiche, and computerized parts identification systems.
    b. Maintain work records to account for parts and labor including verification of completed standard work order forms to indicate the major repairs made, parts used, and time taken.
    c. Conduct product liability procedures including maintenance and repairs performed in compliance with manufacturer's product liability guidelines and the American National Standards Institute (ANSI) Standards.
    d. Prepare customer bill/receipt so that the completed product is legible, is free of mathematical error, and accurately reflects the transaction including service performed, parts repaired or replaced, labor, sales tax, and total cost.

e. Utilize human relations skills in the small engine repair shop to create a pleasant environment and provide customer services with a positive attitude.

Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M7
Workplace Skills (See Appendix B): WP1, WP2, WP3, WP4, WP5, WP6

14. Prepare for employment.
    a. Prepare a resume containing essential information including personal information, education, and employment experience using correct grammar, spelling, and punctuation.
    b. Complete a job application form using correct grammar, spelling, and punctuation.
    c. Explain five procedures for job interviews using correct job etiquette.
    d. Demonstrate the role of an applicant in a job interview using correct interview procedures.
    e. Describe job interview etiquette including behavior, appearance, attire, questioning technique, response to questions, correct English, and knowledge of company products or services.

    Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6
    Workplace Skills (See Appendix B): WP1, WP2, WP3, WP4, WP5, WP6
15. Describe the parts of a four-stroke cycle engine.
    a. Define terms associated with engine parts and overhaul including piston and connecting rod assembly, valve train, crankshaft assembly, and multi-piece crankshaft.
    b. Explain causes of engine problems including allowing dirt to get into engine, overloading engine, running the engine at excessive rpm, and inadequate lubrication.
    c. Identify parts of a piston and connecting rod assembly including piston head, skirt, pin hole, oil ring groove, connecting rod, retaining ring, piston pin, land, ring side clearance, and rod bearing cap.
    d. Identify parts of the crankshaft assembly including main bearing journals, crankpin, and counterweights.
    e. Identify parts of a valve train including margin, seat, stem, face, retainer, cam, head, valve guide, valve spring, adjusting nut, and tappet guide.

    Related Academic Topics (See Appendix A): C1, C2, C3, C4
    Workplace Skills (See Appendix B): WP1, WP2, WP4, WP5, WP6
16. Inspect and overhaul the four-stroke cycle engine.
    a. Disassemble a four-stroke cycle engine according to manufacturer's specifications.
    b. Inspect and overhaul a cylinder according to manufacturer's specifications.
    c. Inspect and overhaul the piston, rings, and connecting rod according to manufacturer's specifications.
    d. Inspect and overhaul a valve assembly according to manufacturer's specifications.

e. Reassemble a four-stroke cycle engine according to manufacturer's specifications.
f. Replace a short block assembly on a four-stroke cycle engine according to manufacturer's specifications.

Related Academic Topics (See Appendix A): C1, C2, C3, C4
Workplace Skills (See Appendix B): WP1, WP2, WP4, WP5, WP6

17. Describe the parts of a two-stroke cycle engine.
    a. Explain causes of two-stroke cycle engine problems including incorrect ratio of two-stroke cycle oil mixture, allowing dirt to get in engine, improper engine speed, and overheating.
    b. Identify parts of the piston and connecting rod assembly including land, ring groove, ring groove pin, connecting rod, needle bearings, rod cap, cap screws, and match marks.
    c. Identify parts of the two-cycle crankshaft assembly including main bearing journals, crankpin, connecting rod bearing journal, and counterweights.

    Related Academic Topics (See Appendix A): C1, C2, C3, C4
    Workplace Skills (See Appendix B): WP1, WP2, WP4, WP5, WP6
18. Inspect and overhaul the two-stroke cycle engine.
    a. Disassemble, inspect, and overhaul a two-stroke cycle engine according to manufacturer's specifications.
    b. Reassemble a two-stroke cycle engine according to manufacturer's specifications.
    c. Replace a short block assembly on a two-stroke cycle engine according to manufacturer's specifications.

    Related Academic Topics (See Appendix A): C1, C2, C3, C4
    Workplace Skills (See Appendix B): WP1, WP2, WP4, WP5, WP6
19. Explain the requirements for small engine operation and the basic steps to troubleshooting.
    a. Describe requirements for an engine to run including compression, ignition, and combustion.
    b. Describe, in order, basic troubleshooting procedures including knowing the engine, asking the operator, inspecting the engine, operating the engine if possible, and formulating a conclusion.

    Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, M6, M8
    Workplace Skills (See Appendix B): WP1, WP2, WP4, WP5, WP6
20. Perform troubleshooting procedures on small engine components including fuel, ignition, and compression.
    a. Troubleshoot the fuel system according to manufacturer's specifications.
    b. Troubleshoot the ignition system according to manufacturer's specifications.

c. Troubleshoot engine compression according to manufacturer's specifications.

Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, M6, M8
Workplace Skills (See Appendix B): WP1, WP2, WP4, WP5, WP6

SECTION II:

CURRICULUM GUIDE

FOR

SMALL ENGINE REPAIR

SMALL ENGINE REPAIR I

SMALL ENGINE REPAIR I
UNIT 1: SAFETY AND ORIENTATION **(5 days)**

Competencies and Suggested Objectives:

1. Explain vocational policies, procedures, and requirements.
   a. Describe grading procedures used in the school.
   b. Describe vocational policies.
   c. Describe school attendance policies.
   d. Describe the student handbook.

   Related Academic Topics (See Appendix A): C1, C3, C5
   Workplace Skills (See Appendix B): WP1, WP2
2. Apply safety laws and standards used in small engine repair.
   a. Describe state eye safety law, including appropriate times for wearing safety glasses.
   b. Define terms associated with safety including accident, safety, first aid, hazardous materials, and OSHA.
   c. Associate the colors of the safety code with their correct application including red, green, yellow, black, white, orange, and blue.
   d. Describe rules for personal and general shop safety related to small engine repair including hygiene, clothing, avoidance of horseplay, shop housekeeping, ventilation, safety equipment, location of fire safety and first aid equipment, shop layout, lifting and hoisting devices, vehicles, flammable liquids, hazardous materials, and pertinent safety codes.

   Related Academic Topics (See Appendix A): C1, C3, C4, C5
   Workplace Skills (See Appendix B): WP1, WP2, WP4
3. Explain procedures for working with and disposing of hazardous materials according to OSHA regulations.
   a. Define terms associated with hazardous materials including carcinogens, batteries, acids, flammables, and radioactive materials.
   b. Identify categories of hazardous materials including exhaust fumes, solvents and degreasers, antifreeze and hydraulic fluids, fuels and lubricants, metal fumes and dust, asbestos, and battery acid.
   c. Identify signal words or symbols that indicate the severity of a hazard including "Caution" used in conjunction with a skull and crossbones (less severe), "Warning" used in conjunction with poison or skull and crossbones (severe), and "Danger" used in conjunction with poison or skull and crossbones (most severe).
   d. Describe methods for reducing hazardous waste including: (1) substitute non-hazardous materials, (2) recycle waste, (3) re-use product, (4) use only amount of product needed, and (5) avoid stockpiling.

e. Identify general procedures for storing hazardous materials and wastes including the following: (1) make sure that all containers are properly labeled at all times, (2) mark all containers containing hazardous waste materials with the words "**HAZARDOUS WASTE**" and with the date that the container was first used to store the waste, (3) store wastes and materials as described by the manufacturer, (4) make sure that containers are intact and secure at all times, and (5) keep all containers secured except when being filled or emptied.
f. Identify and describe the informational sections found on a Material Safety Data Sheet which provide guidelines for creating a safe work environment.
g. Describe general first aid procedures in case of an accident involving hazardous materials: (1) move the victim to fresh air; (2) check the container label, Material Safety Data Sheet, or other source for first aid procedures and begin first aid at once; (3) contact the person designated to help with first aid and evacuation procedures; (4) call an ambulance; (5) follow instructions from the designated person concerning further first aid and evacuation measures; (6) remain with the person until the ambulance arrives; and (7) attach a Material Safety Data Sheet or other information on the material to the person's clothing prior to transport.
h. Identify safety equipment to be used with hazardous materials including protection for eyes, respiratory system, body, and hands.
i. Describe steps to follow in handling spills and waste disposal including: (1) evacuate the area, (2) read container label, (3) call fire department (if flammable), (4) call manufacturer for clean-up instructions, (5) check FRS Manual, (6) use proper protection equipment, and (7) contain the flow of waste.
j. Identify agencies to be contacted in case of an accident or for more information on hazardous materials including National Response Center, EPA Regional Office, and Mississippi Department of Natural Resources.

Related Academic Topics (See Appendix A): C1, C3, C4, C5, S4, S5, S8
Workplace Skills (See Appendix B): WP1, WP2, WP4

Suggested Teaching Strategies:

1. *Explain vocational policies, procedures, and requirements.*
   a. *Have students to read and discuss the student handbook, school policies, and the vocational program requirements.*
2. *Apply safety laws and standards used in small engine repair.*
   a. *Discuss state eye safety law, including appropriate times for wearing safety glasses.*
   b. *Discuss terms associated with safety including accident, safety, first aid, hazardous materials, and OSHA.*

c. *Demonstrate the colors of the safety code with their correct application including red, green, yellow, black, white, orange, and blue.*

d. *Discuss rules and demonstrate procedures for personal and general shop safety related to small engine repair including hygiene, clothing, avoidance of horseplay, shop housekeeping, ventilation, safety equipment, location of fire safety and first aid equipment, shop layout, lifting and hoisting devices, vehicles, flammable liquids, hazardous materials, and pertinent safety codes.*

3. *Explain procedures for working with and disposing of hazardous materials according to OSHA regulations.*

a. *Discuss terms associated with hazardous materials including carcinogens, batteries, acids, flammables, and radioactive materials.*

b. *Discuss categories of hazardous materials including exhaust fumes, solvents and degreasers, antifreeze and hydraulic fluids, fuels and lubricants, metal fumes and dust, asbestos, and battery acid.*

c. *Read and observe labels to identify signal words or symbols that indicate the severity of a hazard including "Caution" used in conjunction with a skull and crossbones (less severe), "Warning" used in conjunction with poison or skull and crossbones (severe), and "Danger" used in conjunction with poison or skull and crossbones (most severe).*

d. *Discuss methods for reducing hazardous waste including: (1) substitute non-hazardous materials, (2) recycle waste, (3) re-use product, (4) use only amount of product needed, and (5) avoid stockpiling.*

e. *Demonstrate general procedures for storing hazardous materials and wastes including the following: (1) make sure that all containers are properly labeled at all times, (2) mark all containers containing hazardous waste materials with the words **"HAZARDOUS WASTE"** and with the date that the container was first used to store the waste, (3) store wastes and materials as described by the manufacturer, (4) make sure that containers are intact and secure at all times, and (5) keep all containers secured except when being filled or emptied.*

f. *Discuss the informational sections found on a Material Safety Data Sheet which provide guidelines for creating a safe work environment.*

g. *Demonstrate general first aid procedures in case of an accident involving hazardous materials: (1) move the victim to fresh air; (2) check the container label, Material Safety Data Sheet, or other source for first aid procedures and begin first aid at once; (3) contact the person designated to help with first aid and evacuation procedures; (4) call an ambulance; (5) follow instructions from the designated person concerning further first aid and evacuation measures; (6) remain with the person until the ambulance arrives; and (7) attach a Material Safety Data Sheet or other information on the material to the person's clothing prior to transport.*

h. *Demonstrate safety equipment to be used with hazardous materials including protection for eyes, respiratory system, body, and hands.*

i. *Discuss procedures to follow in handling spills and waste disposal including: (1) evacuate the area, (2) read container label, (3) call fire department (if flammable), (4) call manufacturer for clean-up instructions, (5) check FRS Manual, (6) use proper protection equipment, and (7) contain the flow of waste.*

j. *Discuss agencies to be contacted in case of an accident or for more information on hazardous materials including National Response Center, EPA Regional Office, and Mississippi Department of Natural Resources.*

Suggested Assessment Strategies:

1. *Explain vocational policies, procedures, and requirements.*
   a. *Test - Describe grading procedures used in the school.*
   b. *Test - Describe vocational policies.*
   c. *Test - Describe school attendance policies.*
   d. *Test - Describe the student handbook.*
2. *Apply safety laws and standards used in small engine repair.*
   a. *Test - Describe state eye safety law, including appropriate times for wearing safety glasses.*
   b. *Test - Define terms associated with safety including accident, safety, first aid, hazardous materials, and OSHA.*
   c. *Performance exercise to associate the colors of the safety code with their correct application including red, green, yellow, black, white, orange, and blue.*
   d. *Performance exercise to apply rules for personal and general shop safety related to small engine repair including hygiene, clothing, avoidance of horseplay, shop housekeeping, ventilation, safety equipment, location of fire safety and first aid equipment, shop layout, lifting and hoisting devices, vehicles, flammable liquids, hazardous materials, and pertinent safety codes.*
3. *Explain procedures for working with and disposing of hazardous materials according to OSHA regulations.*
   a. *Test - Define terms associated with hazardous materials including carcinogens, batteries, acids, flammables, and radioactive materials.*
   b. *Performance exercise to identify categories of hazardous materials including exhaust fumes, solvents and degreasers, antifreeze and hydraulic fluids, fuels and lubricants, metal fumes and dust, asbestos, and battery acid.*
   c. *Performance exercise to identify signal words or symbols that indicate the severity of a hazard including "Caution" used in conjunction with a skull and crossbones (less severe), "Warning" used in conjunction with poison or skull and crossbones (severe), and "Danger" used in conjunction with poison or skull and crossbones (most severe).*

d. *Performance exercise to apply methods for reducing hazardous waste including: (1) substitute non-hazardous materials, (2) recycle waste, (3) re-use product, (4) use only amount of product needed, and (5) avoid stockpiling.*

e. *Performance exercise to apply general procedures for storing hazardous materials and wastes including the following: (1) make sure that all containers are properly labeled at all times, (2) mark all containers containing hazardous waste materials with the words* ***"HAZARDOUS WASTE"*** *and with the date that the container was first used to store the waste, (3) store wastes and materials as described by the manufacturer, (4) make sure that containers are intact and secure at all times, and (5) keep all containers secured except when being filled or emptied.*

f. *Identify and describe the informational sections found on a Material Safety Data Sheet which provide guidelines for creating a safe work environment.*

g. *Performance exercise to apply general first aid procedures in case of an accident involving hazardous materials: (1) move the victim to fresh air; (2) check the container label, Material Safety Data Sheet, or other source for first aid procedures and begin first aid at once; (3) contact the person designated to help with first aid and evacuation procedures; (4) call an ambulance; (5) follow instructions from the designated person concerning further first aid and evacuation measures; (6) remain with the person until the ambulance arrives; and (7) attach a Material Safety Data Sheet or other information on the material to the person's clothing prior to transport.*

h. *Performance exercise to identify safety equipment to be used with hazardous materials including protection for eyes, respiratory system, body, and hands.*

i. *Performance exercise to apply steps to follow in handling spills and waste disposal including: (1) evacuate the area, (2) read container label, (3) call fire department (if flammable), (4) call manufacturer for clean-up instructions, (5) check FRS Manual, (6) use proper protection equipment, and (7) contain the flow of waste.*

j. *Test - Identify agencies to be contacted in case of an accident or for more information on hazardous materials including National Response Center, EPA Regional Office, and Mississippi Department of Natural Resources.*

Suggested References:

Eaddy, V. S. V-TECS Product Elements for Small Engine Repair. Atlanta: Vocational-Technical Education Consortium of the States, in cooperation with Mississippi Department of Education. 1991.

Roth, A. C. & Baird, R. J. Small Gas Engines. South Holland, IL: Goodheart-Wilcox. 1992.

Roth, A. C. & Baird, R. J. Small Gas Engines: Workbook. South Holland, IL: Goodheart-Wilcox. 1992.

Schuster, W. A. Small Engine Technology. Albany, NY: Delmar. 1993.

Warzecha, Mary. Hazardous Materials: Fingertip Retrieval System. Alexandria, VA: American Vocational Association. 1991.

SMALL ENGINE REPAIR I
UNIT 2: TOOLS AND EQUIPMENT **(10 days)**

Competencies and Suggested Objectives:

1. Explain the application and use of hand tools.
   a. Identify basic hand tools needed for maintenance and repair of small engines including screwdrivers, hammers, punches, chisels, and files.
   b. Identify the tools used in overhaul of small engines including special tools, flywheel pullers, ring contractor, valve spring compressors, cylinder hone, ring expander, micrometer, and thickness gauge.
   c. Identify the types of torque wrenches including direct reading, dial, and signaling.
   d. Describe procedures concerning the maintenance of hand tools including re-grinding worn or damaged flat blade screwdrivers, discarding Phillips screwdrivers with damaged heads, keeping pliers clean and rust free, keeping cutting edges sharp and smooth, keeping ratchets clean and well lubricated, and marking all tools with engraving tool.

   Related Academic Topics (See Appendix A): C3, S8
   Workplace Skills (See Appendix B): WP1, WP2, WP4
2. Explain the safe use of power tools and equipment.
   a. Describe the safe use of pneumatic tools.
   b. Service and use an air compressor.
   c. Describe the safe use of electrical drills.
   d. Describe the safe use of bench grinders and portable grinders.
   e. Demonstrate the use of computer equipment and software for parts identification and estimation of repair costs in Small Engine Repair.

   Related Academic Topics (See Appendix A): C3, S8
   Workplace Skills (See Appendix B): WP1, WP2, WP4

Suggested Teaching Strategies:

1. *Explain the application and use of hand tools.*
   a. *Discuss basic hand tools needed for maintenance and repair of small engines including screwdrivers, hammers, punches, chisels, and files.*
   b. *Discuss the tools used in overhaul of small engines including special tools, flywheel pullers, ring contractor, valve spring compressors, cylinder hone, ring expander, micrometer, and thickness gauge.*
   c. *Discuss the types of torque wrenches including direct reading, dial, and signaling.*
   d. *Demonstrate procedures concerning the maintenance of hand tools including re-grinding worn or damaged flat blade screwdrivers, discarding Phillips screwdrivers with damaged heads, keeping pliers clean and rust*

free, keeping cutting edges sharp and smooth, keeping ratchets clean and well lubricated, and marking all tools with engraving tool.

2. *Explain the safe use of power tools and equipment.*
   a. *Demonstrate the safe use of pneumatic tools.*
   b. *Performance exercise to service and use an air compressor.*
   c. *Describe the safe use of electrical drills.*
   d. *Demonstrate the safe use of bench grinders and portable grinders.*
   e. *Performance exercise to demonstrate the use of computer equipment and software for parts identification and estimation of repair costs in Small Engine Repair.*

Suggested Assessment Strategies:

1. *Explain the application and use of hand tools.*
   a. *Test - Identify basic hand tools needed for maintenance and repair of small engines including screwdrivers, hammers, punches, chisels, and files.*
   b. *Performance Activity - Identify the tools used in overhaul of small engines including special tools, flywheel pullers, ring contractor, valve spring compressors, cylinder hone, ring expander, micrometer, and thickness gauge.*
   c. *Performance Activity - Identify the types of torque wrenches including direct reading, dial, and signaling.*
   d. *Performance Activity - Describe procedures concerning the maintenance of hand tools including re-grinding worn or damaged flat blade screwdrivers, discarding Phillips screwdrivers with damaged heads, keeping pliers clean and rust free, keeping cutting edges sharp and smooth, keeping ratchets clean and well lubricated, and marking all tools with engraving tool.*
2. *Explain the safe use of power tools and equipment.*
   a. *Test - Describe the safe use of pneumatic tools.*
   b. *Performance Activity - Service and use an air compressor.*
   c. *Performance Activity - Safely use electrical drills.*
   d. *Performance Activity - Safely use bench grinders and portable grinders.*
   e. *Performance Activity - Demonstrate the use of computer equipment and software for parts identification and estimation of repair costs in Small Engine Repair.*

Suggested References:

Eaddy, V. S. V-TECS Product Elements for Small Engine Repair. Atlanta: Vocational-Technical Education Consortium of the States, in cooperation with Mississippi Department of Education. 1991.

Roth, A. C. & Baird, R. J. Small Gas Engines. South Holland, IL: Goodheart-Wilcox. 1992.

Roth, A. C. & Baird, R. J. Small Gas Engines: Workbook. South Holland, IL: Goodheart-Wilcox. 1992.

Schuster, W. A. Small Engine Technology. Albany, NY: Delmar. 1993.

SMALL ENGINE REPAIR I
UNIT 3: FASTENERS **(5 days)**

Competencies and Suggested Objectives:

1. Explain common fasteners, tools, and procedures for restoring damaged threads.
   a. Identify common fasteners including typical nuts, bolts, special purpose nuts with locking features, devices for locking nuts or bolts, designs of screw heads, and snap rings.
   b. Identify methods used to remove seized nuts including penetrating oil, chisel, gas torch, and hacksaw.
   c. Identify tools used to restore internal and external threads including re-threading tool, tap and die, thread restorers, and internal threading.
   d. Restore internal threads using a thread insert kit (Helicoil) according to manufacturer's specifications.
   e. Utilize torque wrenches to tighten bolts/nuts to manufacturer's specifications.

   Related Academic Topics (See Appendix A): C1, C2, C3, S8
   Workplace Skills (See Appendix B): WP1, WP2, WP6

Suggested Teaching Strategies:

1. *Explain common fasteners, tools, and procedures for restoring damaged threads.*
   a. Identify common fasteners including typical nuts, bolts, special purpose nuts with locking features, devices for locking nuts or bolts, designs of screw heads, and snap rings.
   b. Demonstrate methods used to remove seized nuts including penetrating oil, chisel, gas torch, and hacksaw.
   c. Identify tools used to restore internal and external threads including re-threading tool, tap and die, thread restorers, and internal threading.
   d. Demonstrate restoring internal threads using a thread insert kit (Helicoil) according to manufacturer's specifications.
   e. Demonstrate the use of torque wrenches to tighten bolts/nuts to manufacturer's specifications.

Suggested Assessment Strategies:

1. *Explain common fasteners, tools, and procedures for restoring damaged threads.*
   a. *Test - Identify common fasteners including typical nuts, bolts, special purpose nuts with locking features, devices for locking nuts or bolts, designs of screw heads, and snap rings.*
   b. *Performance Activity - Identify methods used to remove seized nuts including penetrating oil, chisel, gas torch, and hacksaw.*
   c. *Performance Activity - Identify tools used to restore internal and external threads including re-threading tool, tap and die, thread restorers, and internal threading.*
   d. *Performance Activity - Restore internal threads using a thread insert kit (Helicoil) according to manufacturer's specifications.*
   e. *Performance Activity - Utilize torque wrenches to tighten bolts/nuts to manufacturer's specifications.*

Suggested References:

Eaddy, V. S. V-TECS Product Elements for Small Engine Repair. Atlanta: Vocational-Technical Education Consortium of the States, in cooperation with Mississippi Department of Education. 1991.

Roth, A. C. & Baird, R. J. Small Gas Engines. South Holland, IL: Goodheart-Wilcox. 1992.

Roth, A. C. & Baird, R. J. Small Gas Engines: Workbook. South Holland, IL: Goodheart-Wilcox. 1992.

SMALL ENGINE REPAIR I
UNIT 4: MEASUREMENT **(15 days)**

Competencies and Suggested Objectives:

1. Apply measurement procedures used in small engine repair.
   a. Identify measuring instruments used in small engine repair including vernier caliper, feeler gauge, dial indicator, and steel rule.
   b. Use a plain micrometer to measure a given object to within ±.001 inch.
   c. Use a vernier caliper to measure a given object to within ±.001 inch.
   d. Use a 6" rule to measure a given object within 1/16".

   Related Academic Topics (See Appendix A): C1, C2, C4, M4, M7
   Workplace Skills (See Appendix B): WP2, WP4, WP5

Suggested Teaching Strategies:

1. *Apply measurement procedures used in small engine repair.*
   a. *Demonstrate measuring instruments used in small engine repair including vernier caliper, feeler gauge, dial indicator, and steel rule.*
   b. *Demonstrate the use of a plain micrometer to measure a given object to within ±.001 inch.*
   c. *Demonstrate the use of a vernier caliper to measure a given object to within ±.001 inch.*
   d. *Demonstrate the use of a 6" rule to measure a given object within 1/16".*

Suggested Assessment Strategies:

1. *Apply measurement procedures used in small engine repair.*
   a. *Test - Identify measuring instruments used in small engine repair including vernier caliper, feeler gauge, dial indicator, and steel rule.*
   b. *Performance Activity - Use a plain micrometer to measure a given object to within ±.001 inch.*
   c. *Performance Activity - Use a vernier caliper to measure a given object to within ±.001 inch.*
   d. *Performance Activity - Use a 6" rule to measure a given object within 1/16".*

Suggested References:

Eaddy, V. S. V-TECS Product Elements for Small Engine Repair. Atlanta: Vocational-Technical Education Consortium of the States, in cooperation with Mississippi Department of Education. 1991.

Roth, A. C. & Baird, R. J. Small Gas Engines. South Holland, IL: Goodheart-Wilcox. 1992.

Roth, A. C. & Baird, R. J. Small Gas Engines: Workbook. South Holland, IL: Goodheart-Wilcox. 1992.

Schuster, W. A. Small Engine Technology. Albany, NY: Delmar. 1993.

SMALL ENGINE REPAIR I
UNIT 5: ENGINE IDENTIFICATION AND INSPECTION (15 days)

Competencies and Suggested Objectives:

1. Identify types of small engines.
   a. Define new terms associated with engine identification and inspection including combustion, chamber, crankcase, cycle, two-stroke, and four-stroke.
   b. Describe distinguishing characteristics of four-stroke and two-stroke cycle engines: (1) four-stroke cycle engine usually has an oil sump and possibly an oil filter, exhaust muffler connects at the head of the engine cylinder, and compression resistance is felt every other revolution and (2) two-stroke cycle engine does not have an oil sump or oil filter, the exhaust port is about midpoint on the cylinder, and compression resistance is felt every revolution.
   c. Describe categories of information which can be determined from the operator's instructions and/or inspection of the engine including general information, name and address of manufacturer, operating position of crankshaft, service and maintenance specifications, type of engine (two- or four-stroke), and operating position.
   d. Complete an engine identification and inspection form according to manufacturer's specifications.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C6
   Workplace Skills (See Appendix B): WP1, WP2, WP4, WP5

Suggested Teaching Strategies:

1. *Identify types of small engines.*
   a. Discuss new terms associated with engine identification and inspection including combustion, chamber, crankcase, cycle, two-stroke, and four-stroke.
   b. Point out distinguishing characteristics of four-stroke and two-stroke cycle engines: (1) four-stroke cycle engine usually has an oil sump and possibly an oil filter, exhaust muffler connects at the head of the engine cylinder, and compression resistance is felt every other revolution and (2) two-stroke cycle engine does not have an oil sump or oil filter, the exhaust port is about midpoint on the cylinder, and compression resistance is felt every revolution.

c. *Discuss categories of information which can be determined from the operator's instructions and/or inspection of the engine including general information, name and address of manufacturer, operating position of crankshaft, service and maintenance specifications, type of engine (two- or four-stroke), and operating position.*
d. *Demonstrate how to complete an engine identification and inspection form according to manufacturer's specifications.*

Suggested Assessment Strategies:

1. *Identify types of small engines.*
   a. *Test - Define new terms associated with engine identification and inspection including combustion, chamber, crankcase, cycle, two-stroke, and four-stroke.*
   b. *Performance Activity - Describe distinguishing characteristics of four-stroke and two-stroke cycle engines: (1) four-stroke cycle engine usually has an oil sump and possibly an oil filter, exhaust muffler connects at the head of the engine cylinder, and compression resistance is felt every other revolution and (2) two-stroke cycle engine does not have an oil sump or oil filter, the exhaust port is about midpoint on the cylinder, and compression resistance is felt every revolution.*
   c. *Performance Activity - Describe categories of information which can be determined from the operator's instructions and/or inspection of the engine including general information, name and address of manufacturer, operating position of crankshaft, service and maintenance specifications, type of engine (two- or four-stroke), and operating position.*
   d. *Performance Activity - Complete an engine identification and inspection form according to manufacturer's specifications.*

Suggested References:

Briggs & Stratton. Service and Repair Instructions for Single Cylinder 4-Cycle Engines. Milwaukee, WI: Author. 1992.

Briggs & Stratton. Service and Repair Instructions for 2-Cycle Engines (Model 95700 and 96700). Milwaukee, WI: Author. 1993.

Deere & Co. (1992). Engines, Compact Equipment: Fundamentals of Service (3rd ed.). Moline, IL: Author. 1992.

Eaddy, V. S. V-TECS Product Elements for Small Engine Repair. Atlanta: Vocational-Technical Education Consortium of the States, in cooperation with Mississippi Department of Education. 1991.

Roth, A. C. & Baird, R. J. Small Gas Engines. South Holland, IL: Goodheart-Wilcox. 1992.

Roth, A. C. & Baird, R. J. Small Gas Engines: Workbook. South Holland, IL: Goodheart-Wilcox. 1992.

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SMALL ENGINE REPAIR I
UNIT 6: BASIC ENGINE PRINCIPLES AND DESIGN **(15 days)**

Competencies and Suggested Objectives:

1. Explain the principles of operation of an internal combustion engine.
   a. Define terms associated with basic engine principles and design including parts of the basic internal combustion engine, forms of available energy, types of motion, types of energy, and types of engine design.
   b. Describe the parts of a basic internal combustion engine cylinder unit including cylinder, piston, rings, connecting rod, crankshaft, camshaft, and intake and exhaust valves.
   c. Describe steps in the process by which an internal combustion engine converts chemical energy into rotary motion: (1) gasoline and air are introduced into the upper end of the cylinder, (2) heat energy causes the cylinder gases to expand, (3) expansion of burning gases pushes piston down the cylinder, and (4) downward motion of the piston transmits force to the crankshaft through the connecting rod to create rotary motion.

   Related Academic Topics (See Appendix A): C1, C2, C4, S5, S6, S8
   Workplace Skills (See Appendix B): WP1, WP2, WP4
2. Analyze engine horsepower rating.
   a. Read and interpret engine label.
   b. Read and interpret manufacturer's service manual to analyze engine horsepower rating.

   Related Academic Topics (See Appendix A): C1, C2, M4, M7, S5, S6, S8
   Workplace Skills (See Appendix B): WP1, WP2, WP4
3. Explain the principles of four-stroke cycle engine operation.
   a. Define terms associated with the principles of operation of a four-stroke cycle engine including intake stroke, compression stroke, power stroke, exhaust stoke, intake and exhaust valve overlap, camshaft, and valve spring.
   b. Identify basic components of a four-stroke cycle engine including cylinder block, cylinder head, piston, connecting rod, crankshaft, camshaft, valves, and valve spring.
   c. Describe the operation of a four-stroke cycle engine as related to each stroke of the cycle: (1) intake stroke - upward motion of piston which permits fuel-air mixture to enter cylinder via open intake valve, (2) compression stroke - upward movement of piston which compresses fuel-air mixture with both valves closed, (3) power stroke - downward piston movement caused by spark ignition of compressed fuel-air mixture, and (4) exhaust stroke - upward piston movement which expels burned gases from cylinder.

Related Academic Topics (See Appendix A): C1, C2, C4, M4, M7, S5, S6, S8
Workplace Skills (See Appendix B): WP1, WP2, WP4, WP6

4. Explain the principles of two-stroke cycle engine operation.
   a. Define terms associated with the two-stroke cycle engine including expansion chamber, reed valve, rotary valve, exhaust port, intake port, and transfer.
   b. Identify basic components of a two-stroke cycle engine including cylinder, piston, connecting rod, crankcase, and crankshaft.
   c. Describe the steps in the operation of a two-stroke cycle: (1) piston moves up in cylinder drawing fuel-air mixture into crankcase, (2) piston moves down cylinder pressurizing mixture in crankcase, (3) piston moves past transfer port allowing pressurized mixture to move into combustion chamber, and (4) sparkplug fires compress mixture causing piston to move up cylinder closing both transfer and exhaust ports and producing rotary motion of crankshaft.

   Related Academic Topics (See Appendix A): C1, C2, C4, M4, M7, S5, S6, S8
   Workplace Skills (See Appendix B): WP1, WP2, WP4, WP6

Suggested Teaching Strategies:

1. *Explain the principles of operation of an internal combustion engine.*
   a. *Discuss terms associated with basic engine principles and design including parts of the basic internal combustion engine, forms of available energy, types of motion, types of energy, and types of engine design.*
   b. *Point out the parts of a basic internal combustion engine cylinder unit including cylinder, piston, rings, connecting rod, crankshaft, camshaft, and intake and exhaust valves.*
   c. *Demonstrate steps in the process by which an internal combustion engine converts chemical energy into rotary motion: (1) gasoline and air are introduced into the upper end of the cylinder, (2) heat energy causes the cylinder gases to expand, (3) expansion of burning gases pushes piston down the cylinder, and (4) downward motion of the piston transmits force to the crankshaft through the connecting rod to create rotary motion.*
2. *Analyze engine horsepower rating.*
   a. *Demonstrate how to read and interpret engine label.*
   b. *Demonstrate how to read and interpret manufacturer's service manual to analyze engine horsepower rating.*
3. *Explain the principles of four-stroke cycle engine operation.*
   a. *Discuss terms associated with the principles of operation of a four-stroke cycle engine including intake stroke, compression stroke, power stroke, exhaust stoke, intake and exhaust valve overlap, camshaft, and valve spring.*

b. *Point out basic components of a four-stroke cycle engine including cylinder block, cylinder head, piston, connecting rod, crankshaft, camshaft, valves, and valve spring.*

c. *Demonstrate the operation of a four-stroke cycle engine as related to each stroke of the cycle: (1) intake stroke - upward motion of piston which permits fuel-air mixture to enter cylinder via open intake valve, (2) compression stroke - upward movement of piston which compresses fuel-air mixture with both valves closed, (3) power stroke - downward piston movement caused by spark ignition of compressed fuel-air mixture, and (4) exhaust stroke - upward piston movement which expels burned gases from cylinder.*

4. *Explain the principles of two-stroke cycle engine operation.*

a. *Discuss terms associated with the two-stroke cycle engine including expansion chamber, reed valve, rotary valve, exhaust port, intake port, and transfer.*

b. *Point out basic components of a two-stroke cycle engine including cylinder, piston, connecting rod, crankcase, and crankshaft.*

c. *Demonstrate the steps in the operation of a two-stroke cycle: (1) piston moves up in cylinder drawing fuel-air mixture into crankcase, (2) piston moves down cylinder pressurizing mixture in crankcase, (3) piston moves past transfer port allowing pressurized mixture to move into combustion chamber, and (4) sparkplug fires compress mixture causing piston to move up cylinder closing both transfer and exhaust ports and producing rotary motion of crankshaft.*

Suggested Assessment Strategies:

1. *Explain the principles of operation of an internal combustion engine.*

a. *Test - Define terms associated with basic engine principles and design including parts of the basic internal combustion engine, forms of available energy, types of motion, types of energy, and types of engine design.*

b. *Performance Activity - Describe the parts of a basic internal combustion engine cylinder unit including cylinder, piston, rings, connecting rod, crankshaft, camshaft, and intake and exhaust valves.*

c. *Performance Activity - Describe steps in the process by which an internal combustion engine converts chemical energy into rotary motion: (1) gasoline and air are introduced into the upper end of the cylinder, (2) heat energy causes the cylinder gases to expand, (3) expansion of burning gases pushes piston down the cylinder, and (4) downward motion of the piston transmits force to the crankshaft through the connecting rod to create rotary motion.*

2. *Analyze engine horsepower rating.*
   a. *Performance Activity - Read and interpret engine label.*
   b. *Performance Activity - Read and interpret manufacturer's service manual to analyze engine horsepower rating.*
3. *Explain the principles of four-stroke cycle engine operation.*
   a. *Test - Define terms associated with the principles of operation of a four-stroke cycle engine including intake stroke, compression stroke, power stroke, exhaust stoke, intake and exhaust valve overlap, camshaft, and valve spring.*
   b. *Assignment - Identify basic components of a four-stroke cycle engine including cylinder block, cylinder head, piston, connecting rod, crankshaft, camshaft, valves, and valve spring.*
   c. *Assignment - Describe the operation of a four-stroke cycle engine as related to each stroke of the cycle: (1) intake stroke - upward motion of piston which permits fuel-air mixture to enter cylinder via open intake valve, (2) compression stroke - upward movement of piston which compresses fuel-air mixture with both valves closed, (3) power stroke - downward piston movement caused by spark ignition of compressed fuel-air mixture, and (4) exhaust stroke - upward piston movement which expels burned gases from cylinder.*
4. *Explain the principles of 2-stroke cycle engine operation.*
   a. *Test - Define terms associated with the two-stroke cycle engine including expansion chamber, reed valve, rotary valve, exhaust port, intake port, and transfer.*
   b. *Assignment - Identify basic components of a two-stroke cycle engine including cylinder, piston, connecting rod, crankcase, and crankshaft.*
   c. *Assignment - Describe the steps in the operation of a two-stroke cycle: (1) piston moves up in cylinder drawing fuel-air mixture into crankcase, (2) piston moves down cylinder pressurizing mixture in crankcase, (3) piston moves past transfer port allowing pressurized mixture to move into combustion chamber, and (4) sparkplug fires compress mixture causing piston to move up cylinder closing both transfer and exhaust ports and producing rotary motion of crankshaft.*

Suggested References:

Briggs & Stratton. Service and Repair Instructions for Single Cylinder 4-Cycle Engines. Milwaukee, WI: Author. 1992.

Briggs & Stratton. Service and Repair Instructions for 2-Cycle Engines (Model 95700 and 96700). Milwaukee, WI: Author. 1993.

Deere & Co. Engines, Compact Equipment: Fundamentals of Service (3rd ed.). Moline, IL: Author. 1992.

Eaddy, V. S. V-TECS Product Elements for Small Engine Repair. Atlanta: Vocational-Technical Education Consortium of the States, in cooperation with Mississippi Department of Education. 1991.

Roth, A. C. & Baird, R. J. Small Gas Engines. South Holland, IL: Goodheart-Wilcox. 1992.

Roth, A. C. & Baird, R. J. Small Gas Engines: Workbook. South Holland, IL: Goodheart-Wilcox. 1992.

Schuster, W. A. Small Engine Technology. Albany, NY: Delmar. 1993.

SMALL ENGINE REPAIR I
UNIT 7: BASIC ELECTRICITY **(15 days)**

Competencies and Suggested Objectives:

1. Explain the principles of basic electricity.
   a. Define terms associated with basic electricity including ampere, ohm, resistance, voltage, current, conductor, insulator, and circuit.
   b. Describe sources of electricity including chemical and magnetic.
   c. Identify examples of conductors and insulators of electricity including conductors (copper, aluminum, and steel) and insulators (glass, rubber, ceramic, and plastic).
   d. Identify common electrical symbols used in schematic diagrams including battery, ground, solenoid, coil, resistance or load, connection, switch, terminal, and fuse.

   Related Academic Topics (See Appendix A): C1, C3, C4, C6, M7, S6, S8
   Workplace Skills (See Appendix B): WP2, WP4, WP5, WP6
2. Describe instruments and perform measurements of electricity.
   a. Describe instruments used in checking electrical circuits including ammeter, voltmeter, and ohmmeter.
   b. Measure resistance using an ohmmeter in parallel and closed circuits.
   c. Check continuity of a simple circuit using an ohmmeter or test light.
   d. Measure amperage in a circuit using an ammeter.
   e. Check voltage in a circuit using a voltmeter.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C6, M7, S6, S8
   Workplace Skills (See Appendix B): WP2, WP4, WP5, WP6

Suggested Teaching Strategies:

1. *Explain the principles of basic electricity.*
   a. *Discuss terms associated with basic electricity including ampere, ohm, resistance, voltage, current, conductor, insulator, and circuit.*
   b. *Discuss sources of electricity including chemical and magnetic.*
   c. *Provide examples of conductors and insulators of electricity including conductors (copper, aluminum, and steel) and insulators (glass, rubber, ceramic, and plastic).*
   d. *Demonstrate common electrical symbols used in schematic diagrams including battery, ground, solenoid, coil, resistance or load, connection, switch, terminal, and fuse.*
2. *Describe instruments and perform measurements of electricity.*
   a. *Demonstrate instruments used in checking electrical circuits including ammeter, voltmeter, and ohmmeter.*

b. *Demonstrate how to measure resistance using an ohmmeter in parallel and closed circuits.*
c. *Demonstrate how to check continuity of a simple circuit using an ohmmeter or test light.*
d. *Demonstrate how to measure amperage in a circuit using an ammeter.*
e. *Demonstrate how to check voltage in a circuit using a voltmeter.*

Suggested Assessment Strategies:

1. *Explain the principles of basic electricity.*
   a. *Test - Define terms associated with basic electricity including ampere, ohm, resistance, voltage, current, conductor, insulator, and circuit.*
   b. *Oral/written report to describe sources of electricity including chemical and magnetic.*
   c. *Performance Activity - Identify examples of conductors and insulators of electricity including conductors (copper, aluminum, and steel) and insulators (glass, rubber, ceramic, and plastic).*
   d. *Performance Activity - Identify common electrical symbols used in schematic diagrams including battery, ground, solenoid, coil, resistance or load, connection, switch, terminal, and fuse.*
2. *Describe instruments and perform measurements of electricity.*
   a. *Performance Activity - Describe instruments used in checking electrical circuits including ammeter, voltmeter, and ohmmeter.*
   b. *Performance Activity - Measure resistance using an ohmmeter in parallel and closed circuits.*
   c. *Performance Activity - Check continuity of a simple circuit using an ohmmeter or test light.*
   d. *Performance Activity - Measure amperage in a circuit using an ammeter.*
   e. *Performance Activity - Check voltage in a circuit using a voltmeter.*

Suggested References:

Briggs & Stratton. Service and Repair Instructions for Single Cylinder 4-Cycle Engines. Milwaukee, WI: Author. 1992.

Briggs & Stratton. Service and Repair Instructions for 2-Cycle Engines (Model 95700 and 96700). Milwaukee, WI: Author. 1993.

Deere & Co. Engines, Compact Equipment: Fundamentals of Service (3rd ed.). Moline, IL: Author. 1992.

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SMALL ENGINE REPAIR I
UNIT 8: IGNITION SYSTEMS **(10 days)**

Competencies and Suggested Objectives:

1. Explain the components of a small engine ignition system.
   a. Describe the types of ignition systems including battery, magneto, and solid state.
   b. Identify components of a battery ignition system (primary and secondary circuits) including battery, ignition switch, primary winding, contact points, condenser, low voltage wire, secondary winding, rotor, and spark plug.
   c. Identify components of a magneto ignition system (primary and secondary systems) including flywheel with magnets, armature, switch stop, coil, contact points, condenser, spark plug, and high voltage wire.
   d. Identify components of a solid state ignition system including flywheel with magnets, trigger coil, transistorized rectifier, diode rectifier, and ignition coil.
   e. Identify components of a breaker-less ignition system including battery flywheel, trigger module, ignition switch, alternator, stator, ignition coil assembly, and rectifier-regulator.
   f. Describe the purpose of ignition system components including battery, ignition switch, coil, contact points, condenser, breaker cam, diode rectifier, trigger coil, and spark plug.
   g. Describe the operation of ignition systems including battery, magneto, and solid state.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C6, M7, S6, S8
   Workplace Skills (See Appendix B): WP2, WP4, WP5, WP6
2. Service and test small engine ignition systems.
   a. Remove, service, and/or replace spark plugs according to manufacturer's specifications.
   b. Remove and replace contact points and condenser according to manufacturer's specifications.
   c. Test the coil, condenser, armature, and flywheel magnets according to manufacturer's specifications.
   d. Test and adjust a solid state ignition system according to manufacturer's specifications.
   e. Perform a coil power test according to manufacturer's specifications.
   f. Test condenser for leakage or short according to manufacturer's specifications.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C6, M7, S6, S8
   Workplace Skills (See Appendix B): WP2, WP4, WP5, WP6

Suggested Teaching Strategies:

1. *Explain the components of a small engine ignition system.*
   a. *Discuss the types of ignition systems including battery, magneto, and solid state.*
   b. *Point out components of a battery ignition system (primary and secondary circuits) including battery, ignition switch, primary winding, contact points, condenser, low voltage wire, secondary winding, rotor, and spark plug.*
   c. *Point out components of a magneto ignition system (primary and secondary systems) including flywheel with magnets, armature, switch stop, coil, contact points, condenser, spark plug, and high voltage wire.*
   d. *Point out components of a solid state ignition system including flywheel with magnets, trigger coil, transistorized rectifier, diode rectifier, and ignition coil.*
   e. *Point out components of a breaker-less ignition system including battery flywheel, trigger module, ignition switch, alternator, stator, ignition coil assembly, and rectifier-regulator.*
   f. *Discuss the purpose of ignition system components including battery, ignition switch, coil, contact points, condenser, breaker cam, diode rectifier, trigger coil, and spark plug.*
   g. *Demonstrate the operation of ignition systems including battery, magneto, and solid state.*
2. *Service and test small engine ignition systems.*
   a. *Demonstrate procedures to remove, service, and/or replace spark plugs according to manufacturer's specifications.*
   b. *Demonstrate procedures to remove and replace contact points and condenser according to manufacturer's specifications.*
   c. *Demonstrate procedures to test the coil, condenser, armature, and flywheel magnets according to manufacturer's specifications.*
   d. *Demonstrate procedures to test and adjust a solid state ignition system according to manufacturer's specifications.*
   e. *Demonstrate procedures to perform a coil power test according to manufacturer's specifications.*
   f. *Demonstrate procedures to test condenser for leakage or short according to manufacturer's specifications.*

Suggested Assessment Strategies:

1. *Explain the components of a small engine ignition system.*
   a. *Test - Describe the types of ignition systems including battery, magneto, and solid state.*

b. *Performance Activity - Identify components of a battery ignition system (primary and secondary circuits) including battery, ignition switch, primary winding, contact points, condenser, low voltage wire, secondary winding, rotor, and spark plug.*
c. *Performance Activity - Identify components of a magneto ignition system (primary and secondary systems) including flywheel with magnets, armature, switch stop, coil, contact points, condenser, spark plug, and high voltage wire.*
d. *Performance Activity - Identify components of a solid state ignition system including flywheel with magnets, trigger coil, transistorized rectifier, diode rectifier, and ignition coil.*
e. *Performance Activity - Identify components of a breaker-less ignition system including battery flywheel, trigger module, ignition switch, alternator, stator, ignition coil assembly, and rectifier-regulator.*
f. *Performance Activity - Describe the purpose of ignition system components including battery, ignition switch, coil, contact points, condenser, breaker cam, diode rectifier, trigger coil, and spark plug.*
g. *Performance Activity - Describe the operation of ignition systems including battery, magneto, and solid state.*

2. *Service and test small engine ignition systems.*
   a. *Performance Activity - Remove, service, and/or replace spark plugs according to manufacturer's specifications.*
   b. *Performance Activity - Remove and replace contact points and condenser according to manufacturer's specifications.*
   c. *Performance Activity - Test the coil, condenser, armature, and flywheel magnets according to manufacturer's specifications.*
   d. *Performance Activity - Test and adjust a solid state ignition system according to manufacturer's specifications.*
   e. *Performance Activity - Perform a coil power test according to manufacturer's specifications.*
   f. *Performance Activity - Test condenser for leakage or short according to manufacturer's specifications.*

Suggested References:

Briggs & Stratton. Service and Repair Instructions for Single Cylinder 4-Cycle Engines. Milwaukee, WI: Author. 1992.

Briggs & Stratton. Service and Repair Instructions for 2-Cycle Engines (Model 95700 and 96700). Milwaukee, WI: Author. 1993.

Deere & Co. Engines, Compact Equipment: Fundamentals of Service (3rd ed.). Moline, IL: Author. 1992.

Eaddy, V. S. V-TECS Product Elements for Small Engine Repair. Atlanta: Vocational-Technical Education Consortium of the States, in cooperation with Mississippi Department of Education. 1991.

Roth, A. C. & Baird, R. J. Small Gas Engines. South Holland, IL: Goodheart-Wilcox. 1992.

Roth, A. C. & Baird, R. J. Small Gas Engines: Workbook. South Holland, IL: Goodheart-Wilcox. 1992.

Schuster, W. A. Small Engine Technology. Albany, NY: Delmar. 1993.

SMALL ENGINE REPAIR I
UNIT 9: LUBRICATION SYSTEMS **(15 days)**

Competencies and Suggested Objectives:

1. Explain the principles of lubrication and engine oils.
   a. Define terms related to lubrication systems including types of lubrication systems, functions of engine oil, characteristics of good engine oil, and Society of Automotive Excellence (SAE) viscosity number.
   b. Describe the functions of engine oil including reducing friction and wear, keeping parts clean, cooling moving parts, and cushioning moving parts.
   c. Describe the characteristics of an appropriate engine oil including provides a protective film on moving parts, resists breakdown at high temperatures, resists corrosion and rusting, prevents carbon buildup, prevents sludge formation, and flows easily at low temperatures.
   d. Describe factors to consider in selection and use of oils for best engine performance including selection of brands which meet engine manufacturer's specifications, draining and changing at recommended intervals, selecting oils which have been performance tested, and never mixing oils of various specifications.

   Related Academic Topics (See Appendix A): C1, C2, C4, C6, S5, S8
   Workplace Skills (See Appendix B): WP1, WP2, WP4, WP6
2. Perform lubrication services on small engines.
   a. Change engine oil and filter (if present) including replacement or cleaning of oil filter according to manufacturer's specifications.
   b. Service a crankcase breather according to manufacturer's specifications.
   c. Mix lubricant and fuel for a two-stroke cycle engine according to manufacturer's specifications.

   Related Academic Topics (See Appendix A): C1, C2, C4, C6, M7, S5, S8
   Workplace Skills (See Appendix B): WP1, WP2, WP4, WP6
3. Apply procedures for preparing a small engine for storage.
   a. Prepare a small engine for storage according to manufacturer's specifications.

   Related Academic Topics (See Appendix A): C1, C2, C4, C6, S5, S8
   Workplace Skills (See Appendix B): WP1, WP2, WP4, WP6

Suggested Teaching Strategies:

1. *Explain the principles of lubrication and engine oils.*
   a. *Discuss terms related to lubrication systems including types of lubrication systems, functions of engine oil, characteristics of good engine oil, and Society of Automotive Excellence (SAE) viscosity number.*

b. *Discuss the functions of engine oil including reduction of friction and wear, keeping parts clean, cooling moving parts, and cushioning moving parts.*
c. *Discuss the characteristics of an appropriate engine oil including provides a protective film on moving parts, resists breakdown at high temperatures, resists corrosion and rusting, prevents carbon buildup, prevents sludge formation, and flows easily at low temperatures.*
d. *Discuss factors to consider in selection and use of oils for best engine performance including selection of brands which meet engine manufacturer's specifications, draining and changing at recommended intervals, selecting oils which have been performance tested, and never mixing oils of various specifications.*

2. *Perform lubrication services on small engines.*
   a. *Demonstrate how to change engine oil and filter (if present) including replacement or cleaning of oil filter according to manufacturer's specifications.*
   b. *Demonstrate how to service a crankcase breather according to manufacturer's specifications.*
   c. *Demonstrate how to mix lubricant and fuel for a two-stroke cycle engine according to manufacturer's specifications.*
3. *Apply procedures for preparing a small engine for storage.*
   a. *Demonstrate how to prepare a small engine for storage according to manufacturer's specifications.*

Suggested Assessment Strategies:

1. *Explain the principles of lubrication and engine oils.*
   a. *Test - Define terms related to lubrication systems including types of lubrication systems, functions of engine oil, characteristics of good engine oil, and Society of Automotive Excellence (SAE) viscosity number.*
   b. *Assignment - Describe the functions of engine oil including reducing friction and wear, keeping parts clean, cooling moving parts, and cushioning moving parts.*
   c. *Assignment - Oral/written report to describe the characteristics of an appropriate engine oil including provides a protective film on moving parts, resists breakdown at high temperatures, resists corrosion and rusting, prevents carbon buildup, prevents sludge formation, and flows easily at low temperatures.*
   d. *Assignment - Oral/written report to describe factors to consider in selection and use of oils for best engine performance including selection of brands which meet engine manufacturer's specifications, draining and changing at recommended intervals, selecting oils which have been performance tested, and never mixing oils of various specifications.*

2. *Perform lubrication services on small engines.*
   a. *Performance Activity - Change engine oil and filter (if present) including replacement or cleaning of oil filter according to manufacturer's specifications.*
   b. *Performance Activity - Service a crankcase breather according to manufacturer's specifications.*
   c. *Performance Activity - Mix lubricant and fuel for a two-stroke cycle engine according to manufacturer's specifications.*
3. *Apply procedures for preparing a small engine for storage.*
   a. *Performance Activity - Prepare a small engine for storage according to manufacturer's specifications.*

Suggested References:

Briggs & Stratton. Service and Repair Instructions for Single Cylinder 4-Cycle Engines. Milwaukee, WI: Author. 1992.

Briggs & Stratton. Service and Repair Instructions for 2-Cycle Engines (Model 95700 and 96700). Milwaukee, WI: Author. 1993.

Deere & Co. Engines, Compact Equipment: Fundamentals of Service (3rd ed.). Moline, IL: Author. 1992.

Eaddy, V. S. V-TECS Product Elements for Small Engine Repair. Atlanta: Vocational-Technical Education Consortium of the States, in cooperation with Mississippi Department of Education. 1991.

Roth, A. C. & Baird, R. J.Small Gas Engines. South Holland, IL: Goodheart-Wilcox. 1992.

Roth, A. C. & Baird, R. J. Small Gas Engines: Workbook. South Holland, IL: Goodheart-Wilcox. 1992.

Schuster, W. A. Small Engine Technology. Albany, NY: Delmar. 1993.

SMALL ENGINE REPAIR I
UNIT 10: COOLING SYSTEMS **(15 days)**

Competencies and Suggested Objectives:

1. Service an air-cooled small engine system.
   a. Define terms associated with air-cooled cooling systems including conduction, convection, air-cooled system, liquid-cooled system, and cooling fin.
   b. Identify components of an air-cooled engine cooling system including flywheel, filter screen, blower shroud, air deflector, and cylinder baffle.
   c. Remove, clean, and replace air cooling system parts according to manufacturer's specifications.

   Related Academic Topics (See Appendix A): C1, C2, C3, C6, S8
   Workplace Skills (See Appendix B): WP1, WP2, WP5, WP6
2. Service a water-cooled small engine system.
   a. Identify the parts of a water-cooled engine cooling system including radiator, upper and lower radiator hose, thermostat housing, thermostat, and water pump.
   b. Inspect and service a water-cooled engine cooling system including checking the radiator for leaks, checking the hoses, draining and flushing the system, checking the thermostat, checking the radiator cap, and refilling the system with antifreeze mixture according to manufacturer's specifications.

   Related Academic Topics (See Appendix A): C1, C2, C3, C6, M7, S8
   Workplace Skills (See Appendix B): WP1, WP2, WP5, WP6

Suggested Teaching Strategies:

1. *Service an air-cooled small engine system.*
   a. *Discuss terms associated with air-cooled cooling systems including conduction, convection, air-cooled system, liquid-cooled system, and cooling fin.*
   b. *Point out components of an air-cooled engine cooling system including flywheel, filter screen, blower shroud, air deflector, and cylinder baffle.*
   c. *Demonstrate procedures to remove, clean, and replace air cooling system parts according to manufacturer's specifications.*
2. *Service a water-cooled small engine system.*
   a. *Point out the parts of a water-cooled engine cooling system including radiator, upper and lower radiator hose, thermostat housing, thermostat, and water pump.*

b. *Demonstrate procedures to inspect and service a water-cooled engine cooling system including checking the radiator for leaks, checking the hoses, draining and flushing the system, checking the thermostat, checking the radiator cap, and refilling the system with antifreeze mixture according to manufacturer's specifications.*

Suggested Assessment Strategies:

1. *Service an air-cooled small engine system.*
   a. *Test - Define terms associated with air-cooled cooling systems including conduction, convection, air-cooled system, liquid-cooled system, and cooling fin.*
   b. *Performance Activity - Identify components of an air-cooled engine cooling system including flywheel, filter screen, blower shroud, air deflector, and cylinder baffle.*
   c. *Performance Activity - Remove, clean, and replace air cooling system parts according to manufacturer's specifications.*
2. *Service a water-cooled small engine system.*
   a. *Test - Identify the parts of a water-cooled engine cooling system including radiator, upper and lower radiator hose, thermostat housing, thermostat, and water pump.*
   b. *Performance Activity - Inspect and service a water-cooled engine cooling system including checking the radiator for leaks, checking the hoses, draining and flushing the system, checking the thermostat, checking the radiator cap, and refilling the system with antifreeze mixture according to manufacturer's specifications.*

Suggested References:

Briggs & Stratton. Service and Repair Instructions for Single Cylinder 4-Cycle Engines. Milwaukee, WI: Author. 1992.

Briggs & Stratton. Service and Repair Instructions for 2-Cycle Engines (Model 95700 and 96700). Milwaukee, WI: Author. 1993.

Deere & Co. Engines, Compact Equipment: Fundamentals of Service (3rd ed.). Moline, IL: Author. 1992.

Eaddy, V. S. V-TECS Product Elements for Small Engine Repair. Atlanta: Vocational-Technical Education Consortium of the States, in cooperation with Mississippi Department of Education. 1991.

Roth, A. C. & Baird, R. J. Small Gas Engines. South Holland, IL: Goodheart-Wilcox. 1992.

Roth, A. C. & Baird, R. J. Small Gas Engines: Workbook. South Holland, IL: Goodheart-Wilcox. 1992.

Schuster, W. A. Small Engine Technology. Albany, NY: Delmar. 1993.

SMALL ENGINE REPAIR I
UNIT 11: FUEL SYSTEMS (CARBURETOR-TYPE) **(15 days)**

Competencies and Suggested Objectives:

1. Identify fuel and fuel systems used in small engines.
   a. Describe benefits of using unleaded fuel in most new small gas engines including lower exhaust emissions and less carbon accumulation.
   b. Identify the components of a typical carburetor-type fuel system including fuel tank, fuel filter, carburetor, fuel pump, fuel line, and air cleaner.
   c. Identify the different types of fuel filters including in-line, screen in fuel tank, and glass sediment bowl with screen.
   d. Identify the different types of air cleaners including oil bath, paper element, and polyurethane.
   e. Identify the parts of a float-type carburetor including float needle, fuel inlet, float needle seat, float, needle valve, choke valve, and venturi.
   f. Identify the parts of a diaphragm-type carburetor including diaphragm, idle adjusting screw, needle valve, spring and cap, choke, and fuel pipes.
   g. Describe functions of the carburetor to include vaporizing of gasoline, choke system, primer system, high speed adjustment, and idle speed adjustment.

   Related Academic Topics (See Appendix A): C1, C2, C3, C6
   Workplace Skills (See Appendix B): WP1, WP2, WP4, WP5, WP6
2. Remove, service, replace, and adjust an air cleaner, oil bath cleaner, float-type carburetor, and diaphragm-type carburetor.
   a. Service an air cleaner (paper element and polyurethane) according to manufacturer's specifications.
   b. Service an oil bath air cleaner according to manufacturer's specifications.
   c. Remove, service, replace, and adjust a float-type carburetor according to manufacturer's specifications.
   d. Remove, service, replace, and adjust a diaphragm-type carburetor according to manufacturer's specifications.

   Related Academic Topics (See Appendix A): C1, C2, C3, C6
   Workplace Skills (See Appendix B): WP1, WP2, WP4, WP5, WP6

Suggested Teaching Strategies:

1. *Identify fuel and fuel systems used in small engines.*
   a. Discuss benefits of using unleaded fuel in most new small gas engines including lower exhaust emissions and less carbon accumulation.
   b. Demonstrate the components of a typical carburetor-type fuel system including fuel tank, fuel filter, carburetor, fuel pump, fuel line, and air cleaner.

c. *Provide examples of the different types of fuel filters including in-line, screen in fuel tank, and glass sediment bowl with screen.*
d. *Provide examples of the different types of air cleaners including oil bath, paper element, and polyurethane.*
e. *Point out the parts of a float-type carburetor including float needle, fuel inlet, float needle seat, float, needle valve, choke valve, and venturi.*
f. *Point out the parts of a diaphragm-type carburetor including diaphragm, idle adjusting screw, needle valve, spring and cap, choke, and fuel pipes.*
g. *Demonstrate functions of the carburetor to include vaporizing of gasoline, choke system, primer system, high speed adjustment, and idle speed adjustment.*

2. *Remove, service, replace, and adjust an air cleaner, oil bath cleaner, float-type carburetor, and diaphragm-type carburetor.*
   a. *Demonstrate procedures to service an air cleaner (paper element and polyurethane) according to manufacturer's specifications.*
   b. *Demonstrate procedures to service an oil bath air cleaner according to manufacturer's specifications.*
   c. *Demonstrate procedures to remove, service, replace, and adjust a float-type carburetor according to manufacturer's specifications.*
   d. *Demonstrate procedures to remove, service, replace, and adjust a diaphragm-type carburetor according to manufacturer's specifications.*

Suggested Assessment Strategies:

1. *Identify fuel and fuel systems used in small engines.*
   a. *Oral/written report to describe benefits of using unleaded fuel in most new small gas engines including lower exhaust emissions and less carbon accumulation.*
   b. *Performance Activity - Identify the components of a typical carburetor-type fuel system including fuel tank, fuel filter, carburetor, fuel pump, fuel line, and air cleaner.*
   c. *Performance Activity - Identify the different types of fuel filters including in-line, screen in fuel tank, and glass sediment bowl with screen.*
   d. *Performance Activity - Identify the different types of air cleaners including oil bath, paper element, and polyurethane.*
   e. *Performance Activity - Identify the parts of a float-type carburetor including float needle, fuel inlet, float needle seat, float, needle valve, choke valve, and venturi.*
   f. *Performance Activity - Identify the parts of a diaphragm-type carburetor including diaphragm, idle adjusting screw, needle valve, spring and cap, choke, and fuel pipes.*
   g. *Performance Activity - Describe functions of the carburetor to include vaporizing of gasoline, choke system, primer system, high speed adjustment, and idle speed adjustment.*

2. *Remove, service, replace, and adjust an air cleaner, oil bath cleaner, float-type carburetor, and diaphragm-type carburetor.*
   a. *Performance Activity - Service an air cleaner (paper element and polyurethane) according to manufacturer's specifications.*
   b. *Performance Activity - Service an oil bath air cleaner according to manufacturer's specifications.*
   c. *Performance Activity - Remove, service, replace, and adjust a float-type carburetor according to manufacturer's specifications.*
   d. *Performance Activity - Remove, service, replace, and adjust a diaphragm-type carburetor according to manufacturer's specifications.*

Suggested References:

Briggs & Stratton. Service and Repair Instructions for Single Cylinder 4-Cycle Engines. Milwaukee, WI: Author. 1992.

Briggs & Stratton. Service and Repair Instructions for 2-Cycle Engines (Model 95700 and 96700). Milwaukee, WI: Author. 1993.

Deere & Co. Engines, Compact Equipment: Fundamentals of Service (3rd ed.). Moline, IL: Author. 1992.

Eaddy, V. S. V-TECS Product Elements for Small Engine Repair. Atlanta: Vocational-Technical Education Consortium of the States, in cooperation with Mississippi Department of Education. 1991.

Roth, A. C. & Baird, R. J. Small Gas Engines. South Holland, IL: Goodheart-Wilcox. 1992.

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Schuster, W. A. Small Engine Technology. Albany, NY: Delmar. 1993.

SMALL ENGINE REPAIR II

SMALL ENGINE REPAIR II
UNIT 1: SAFETY AND ORIENTATION (REVIEW AND REINFORCEMENT) (5 days)

Competencies and Suggested Objectives:

1. Explain vocational policies, procedures, and requirements.
   a. Describe grading procedures used in the school.
   b. Describe vocational policies.
   c. Describe school attendance policies.
   d. Describe the student handbook.

   Related Academic Topics (See Appendix A): C1, C3, C5
   Workplace Skills (See Appendix B): WP1, WP2
2. Apply safety laws and standards used in small engine repair.
   a. Describe state eye safety law, including appropriate times for wearing safety glasses.
   b. Define terms associated with safety including accident, safety, first aid, hazardous materials, and OSHA.
   c. Associate the colors of the safety code with their correct application including red, green, yellow, black, white, orange, and blue.
   d. Describe rules for personal and general shop safety related to small engine repair including hygiene, clothing, avoidance of horseplay, shop housekeeping, ventilation, safety equipment, location of fire safety and first aid equipment, shop layout, lifting and hoisting devices, vehicles, flammable liquids, hazardous materials, and pertinent safety codes.

   Related Academic Topics (See Appendix A): C1, C3, C4, C5
   Workplace Skills (See Appendix B): WP1, WP2, WP4
3. Explain procedures for working with and disposing of hazardous materials according to OSHA regulations.
   a. Define terms associated with hazardous materials including carcinogens, batteries, acids, flammables, and radioactive materials.
   b. Identify categories of hazardous materials including exhaust fumes, solvents and degreasers, antifreeze and hydraulic fluids, fuels and lubricants, metal fumes and dust, asbestos, and battery acid.
   c. Identify signal words or symbols that indicate the severity of a hazard including "Caution" used in conjunction with a skull and crossbones (less severe), "Warning" used in conjunction with poison or skull and crossbones (severe), and "Danger" used in conjunction with poison or skull and crossbones (most severe).
   d. Describe methods for reducing hazardous waste including: (1) substitute non-hazardous materials, (2) recycle waste, (3) re-use product, (4) use only amount of product needed, and (5) avoid stockpiling.

e. Identify general procedures for storing hazardous materials and wastes including the following: (1) make sure that all containers are properly labeled at all times, (2) mark all containers containing hazardous waste materials with the words **"HAZARDOUS WASTE"** and with the date that the container was first used to store the waste, (3) store wastes and materials as described by the manufacturer, (4) make sure that containers are intact and secure at all times, and (5) keep all containers secured except when being filled or emptied.
f. Identify and describe the informational sections found on a Material Safety Data Sheet which provide guidelines for creating a safe work environment.
g. Describe general first aid procedures in case of an accident involving hazardous materials: (1) move the victim to fresh air; (2) check the container label, Material Safety Data Sheet, or other source for first aid procedures and begin first aid at once; (3) contact the person designated to help with first aid and evacuation procedures; (4) call an ambulance; (5) follow instructions from the designated person concerning further first aid and evacuation measures; (6) remain with the person until the ambulance arrives; and (7) attach a Material Safety Data Sheet or other information on the material to the person's clothing prior to transport.
h. Identify safety equipment to be used with hazardous materials including protection for eyes, respiratory system, body, and hands.
i. Describe steps to follow in handling spills and waste disposal including: (1) evacuate the area, (2) read container label, (3) call fire department (if flammable), (4) call manufacturer for clean-up instructions, (5) check FRS Manual, (6) use proper protection equipment, and (7) contain the flow of waste.
j. Identify agencies to be contacted in case of an accident or for more information on hazardous materials including National Response Center, EPA Regional Office, and Mississippi Department of Natural Resources.

Related Academic Topics (See Appendix A): C1, C3, C4, C5, S4, S5, S8
Workplace Skills (See Appendix B): WP1, WP2, WP4

Suggested Teaching Strategies:

1. *Explain vocational policies, procedures, and requirements.*
   a. *Have students to read and discuss the student handbook, school policies, and the vocational program requirements.*
2. *Apply safety laws and standards used in small engine repair.*
   a. *Discuss state eye safety law, including appropriate times for wearing safety glasses.*
   b. *Discuss terms associated with safety including accident, safety, first aid, hazardous materials, and OSHA.*

c. *Demonstrate the colors of the safety code with their correct application including red, green, yellow, black, white, orange, and blue.*
d. *Discuss rules and demonstrate procedures for personal and general shop safety related to small engine repair including hygiene, clothing, avoidance of horseplay, shop housekeeping, ventilation, safety equipment, location of fire safety and first aid equipment, shop layout, lifting and hoisting devices, vehicles, flammable liquids, hazardous materials, and pertinent safety codes.*

3. *Explain procedures for working with and disposing of hazardous materials according to OSHA regulations.*
   a. *Discuss terms associated with hazardous materials including carcinogens, batteries, acids, flammables, and radioactive materials.*
   b. *Discuss categories of hazardous materials including exhaust fumes, solvents and degreasers, antifreeze and hydraulic fluids, fuels and lubricants, metal fumes and dust, asbestos, and battery acid.*
   c. *Read and observe labels to identify signal words or symbols that indicate the severity of a hazard including "Caution" used in conjunction with a skull and crossbones (less severe), "Warning" used in conjunction with poison or skull and crossbones (severe), and "Danger" used in conjunction with poison or skull and crossbones (most severe).*
   d. *Discuss methods for reducing hazardous waste including: (1) substitute non-hazardous materials, (2) recycle waste, (3) re-use product, (4) use only amount of product needed, and (5) avoid stockpiling.*
   e. *Demonstrate general procedures for storing hazardous materials and wastes including the following: (1) make sure that all containers are properly labeled at all times, (2) mark all containers containing hazardous waste materials with the words **"HAZARDOUS WASTE"** and with the date that the container was first used to store the waste, (3) store wastes and materials as described by the manufacturer, (4) make sure that containers are intact and secure at all times, and (5) keep all containers secured except when being filled or emptied.*
   f. *Discuss the informational sections found on a Material Safety Data Sheet which provide guidelines for creating a safe work environment.*
   g. *Demonstrate general first aid procedures in case of an accident involving hazardous materials: (1) move the victim to fresh air; (2) check the container label, Material Safety Data Sheet, or other source for first aid procedures and begin first aid at once; (3) contact the person designated to help with first aid and evacuation procedures; (4) call an ambulance; (5) follow instructions from the designated person concerning further first aid and evacuation measures; (6) remain with the person until the ambulance arrives; and (7) attach a Material Safety Data Sheet or other information on the material to the person's clothing prior to transport.*
   h. *Demonstrate safety equipment to be used with hazardous materials including protection for eyes, respiratory system, body, and hands.*

i. *Discuss procedures to follow in handling spills and waste disposal including: (1) evacuate the area, (2) read container label, (3) call fire department (if flammable), (4) call manufacturer for clean-up instructions, (5) check FRS Manual, (6) use proper protection equipment, and (7) contain the flow of waste.*

j. *Discuss agencies to be contacted in case of an accident or for more information on hazardous materials including National Response Center, EPA Regional Office, and Mississippi Department of Natural Resources.*

Suggested Assessment Strategies:

1. *Explain vocational policies, procedures, and requirements.*
   a. *Test - Describe grading procedures used in the school.*
   b. *Test - Describe vocational policies.*
   c. *Test - Describe school attendance policies.*
   d. *Test - Describe the student handbook.*
2. *Apply safety laws and standards used in small engine repair.*
   a. *Test - Describe state eye safety law, including appropriate times for wearing safety glasses.*
   b. *Test - Define terms associated with safety including accident, safety, first aid, hazardous materials, and OSHA.*
   c. *Performance exercise to associate the colors of the safety code with their correct application including red, green, yellow, black, white, orange, and blue.*
   d. *Performance exercise to apply rules for personal and general shop safety related to small engine repair including hygiene, clothing, avoidance of horseplay, shop housekeeping, ventilation, safety equipment, location of fire safety and first aid equipment, shop layout, lifting and hoisting devices, vehicles, flammable liquids, hazardous materials, and pertinent safety codes.*
3. *Explain procedures for working with and disposing of hazardous materials according to OSHA regulations.*
   a. *Test - Define terms associated with hazardous materials including carcinogens, batteries, acids, flammables, and radioactive materials.*
   b. *Performance exercise to identify categories of hazardous materials including exhaust fumes, solvents and degreasers, antifreeze and hydraulic fluids, fuels and lubricants, metal fumes and dust, asbestos, and battery acid.*
   c. *Performance exercise to identify signal words or symbols that indicate the severity of a hazard including "Caution" used in conjunction with a skull and crossbones (less severe), "Warning" used in conjunction with poison or skull and crossbones (severe), and "Danger" used in conjunction with poison or skull and crossbones (most severe).*

d. Performance exercise to including methods for reducing hazardous waste including: (1) substitute non-hazardous materials, (2) recycle waste, (3) re-use product, (4) use only amount of product needed, and (5) avoid stockpiling.

*e. Performance exercise to apply general procedures for storing hazardous materials and wastes including the following: (1) make sure that all containers are properly labeled at all times, (2) mark all containers containing hazardous waste materials with the words **"HAZARDOUS WASTE"** and with the date that the container was first used to store the waste, (3) store wastes and materials as described by the manufacturer, (4) make sure that containers are intact and secure at all times, and (5) keep all containers secured except when being filled or emptied.*

f. Identify and describe the informational sections found on a Material Safety Data Sheet which provide guidelines for creating a safe work environment.

g. Performance exercise to apply general first aid procedures in case of an accident involving hazardous materials: (1) move the victim to fresh air; (2) check the container label, Material Safety Data Sheet, or other source for first aid procedures and begin first aid at once; (3) contact the person designated to help with first aid and evacuation procedures; (4) call an ambulance; (5) follow instructions from the designated person concerning further first aid and evacuation measures; (6) remain with the person until the ambulance arrives; and (7) attach a Material Safety Data Sheet or other information on the material to the person's clothing prior to transport.

h. Performance exercise to identify safety equipment to be used with hazardous materials including protection for eyes, respiratory system, body, and hands.

i. Performance exercise to apply steps to follow in handling spills and waste disposal including: (1) evacuate the area, (2) read container label, (3) call fire department (if flammable), (4) call manufacturer for clean-up instructions, (5) check FRS Manual, (6) use proper protection equipment, and (7) contain the flow of waste.

j. Test - Identify agencies to be contacted in case of an accident or for more information on hazardous materials including National Response Center, EPA Regional Office, and Mississippi Department of Natural Resources.

Suggested References:

Eaddy, V. S. V-TECS Product Elements for Small Engine Repair. Atlanta: Vocational-Technical Education Consortium of the States, in cooperation with Mississippi Department of Education. 1991.

Roth, A. C. & Baird, R. J. Small Gas Engines. South Holland, IL: Goodheart-Wilcox. 1992.

Roth, A. C. & Baird, R. J. Small Gas Engines: Workbook. South Holland, IL: Goodheart-Wilcox. 1992.

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Warzecha, Mary. Hazardous Materials: Fingertip Retrieval System. Alexandria, VA: American Vocational Association. 1991.

SMALL ENGINE REPAIR II
UNIT 2: CHARGING SYSTEMS **(10 days)**

Competencies and Suggested Objectives:

1. Explain the components of small engine charging systems.
   a. Identify components of the charging system and state the function(s) of each, including generator or alternator, regulator, and ammeter.
   b. Identify the parts of an alternator charging system including alternator coil or stator, flywheel, rectifier, and battery.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C6, M7, S6, S8
   Workplace Skills (See Appendix B): WP2, WP4, WP5, WP6
2. Service a small engine charging system.
   a. Remove, check, and replace an alternator according to manufacturer's specifications.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C6, M7, S6, S8
   Workplace Skills (See Appendix B): WP2, WP4, WP5, WP6

Suggested Teaching Strategies:

1. *Explain the components of small engine charging systems.*
   a. Discuss components of the charging system and state the function(s) of each, including generator or alternator, regulator, and ammeter.
   b. Point out the parts of an alternator charging system including alternator coil or stator, flywheel, rectifier, and battery.
2. *Service a small engine charging system.*
   a. Performance exercise to remove, check, and replace an alternator according to manufacturer's specifications.

Suggested Assessment Strategies:

1. *Explain the components of small engine charging systems.*
   a. Test - Identify components of the charging system and state the function(s) of each, including generator or alternator, regulator, and ammeter.
   b. Performance Activity - Identify the parts of an alternator charging system including alternator coil or stator, flywheel, rectifier, and battery.
2. *Service a small engine charging system.*
   a. Performance Activity - Remove, check, and replace an alternator according to manufacturer's specifications.

Suggested References:

Briggs & Stratton. Service and Repair Instructions for Single Cylinder 4-Cycle Engines. Milwaukee, WI: Author. 1992.

Briggs & Stratton. Service and Repair Instructions for 2-Cycle Engines (Model 95700 and 96700). Milwaukee, WI: Author. 1993.

Deere & Co. Engines, Compact Equipment: Fundamentals of Service (3rd ed.). Moline, IL: Author. 1992.

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Schuster, W. A. Small Engine Technology. Albany, NY: Delmar. 1993.

SMALL ENGINE REPAIR II
UNIT 3: GOVERNOR SYSTEMS (10 days)

Competencies and Suggested Objectives:

1. Explain governor systems used in small engines.
   a. Describe purposes of the governor system including maintenance of selected speed, prevention of over-speeding that may cause engine damage, and limiting high and low speeds.
   b. Identify components of an air vane governor system and state the purpose of each including air vane, throttle linkage, flywheel, and control spring.
   c. Identify components of a mechanical governor system and state the purpose of each including throttle control, throttle rod, throttle linkage, control spring, and flyweights.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C6
   Workplace Skills (See Appendix B): WP2, WP4, WP5, WP6
2. Inspect, adjust, and repair small engine governor systems.
   a. Inspect, adjust, and repair an air vane governor according to manufacturer's specifications.
   b. Inspect, adjust, and repair a mechanical governor with internal flyweights according to manufacturer's specifications.
   c. Service small engine controls according to manufacturer's specifications.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C6
   Workplace Skills (See Appendix B): WP2, WP4, WP5, WP6

Suggested Teaching Strategies:

1. *Explain governor systems used in small engines.*
   a. *Discuss purposes of the governor system including maintenance of selected speed, prevention of over-speeding that may cause engine damage, and limiting high and low speeds.*
   b. *Point out components of an air vane governor system and discuss the purpose of each including air vane, throttle linkage, flywheel, and control spring.*
   c. *Point out components of a mechanical governor system and discuss the purpose of each including throttle control, throttle rod, throttle linkage, control spring, and flyweights.*
2. *Inspect, adjust, and repair small engine governor systems.*
   a. *Demonstrate how to inspect, adjust, and repair an air vane governor according to manufacturer's specifications.*
   b. *Demonstrate how to inspect, adjust, and repair a mechanical governor with internal flyweights according to manufacturer's specifications.*

c. *Demonstrate how to service small engine controls according to manufacturer's specifications.*

Suggested Assessment Strategies:

1. *Explain governor systems used in small engines.*
   a. *Test - Describe purposes of the governor system including maintenance of selected speed, prevention of over-speeding that may cause engine damage, and limiting high and low speeds.*
   b. *Oral/written report to identify components of an air vane governor system and state the purpose of each including air vane, throttle linkage, flywheel, and control spring.*
   c. *Oral/written report to identify components of a mechanical governor system and state the purpose of each including throttle control, throttle rod, throttle linkage, control spring, and flyweights.*
2. *Inspect, adjust, and repair small engine governor systems.*
   a. *Performance Activity - Inspect, adjust, and repair an air vane governor according to manufacturer's specifications.*
   b. *Performance Activity - Inspect, adjust, and repair a mechanical governor with internal flyweights according to manufacturer's specifications.*
   c. *Performance Activity - Service small engine controls according to manufacturer's specifications.*

Suggested References:

Briggs & Stratton. Service and Repair Instructions for Single Cylinder 4-Cycle Engines. Milwaukee, WI: Author. 1992.

Briggs & Stratton. Service and Repair Instructions for 2-Cycle Engines (Model 95700 and 96700). Milwaukee, WI: Author. 1993.

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SMALL ENGINE REPAIR II
UNIT 4: STARTING SYSTEMS **(10 days)**

Competencies and Suggested Objectives:

1. Explain the components of small engine starting systems.
   a. Describe the types of starting systems including rope wind, rope recoil, and electric (AC and DC).
   b. Identify the components of a mechanical starting system and state the function of each including starter housing, recoil spring, pulley, and engaging pawl or dog.
   c. Identify the components of a DC starting system and state the function of each including battery, key switch, starter motor, switch wire, and battery cables.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C6, M7, S6, S8
   Workplace Skills (See Appendix B): WP2, WP4, WP5, WP6
2. Test/service small engine starting systems.
   a. Remove, test/service, and replace a DC starter according to manufacturer's specifications.
   b. Replace a starter rewind spring according to manufacturer's specifications.
   c. Service the vertical pull starter according to manufacturer's specifications.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C6, M7, S6, S8
   Workplace Skills (See Appendix B): WP2, WP4, WP5, WP6

Suggested Teaching Strategies:

1. *Explain the components of small engine starting systems.*
   a. Discuss the types of starting systems including rope wide, rope recoil, and electric (AC and DC).
   b. Point out the components of a mechanical starting system and state the function of each including starter housing, recoil spring, pulley, and engaging pawl or dog.
   c. Point out the components of a DC starting system and state the function of each including battery, key switch, starter motor, switch wire, and battery cables.
2. *Test/service small engine starting systems.*
   a. Demonstrate procedures to remove, test/service, and replace a DC starter according to manufacturer's specifications.
   b. Demonstrate procedures to replace a starter rewind spring according to manufacturer's specifications.
   c. Demonstrate procedures to service the vertical pull starter according to manufacturer's specifications.

Suggested Assessment Strategies:

1. *Explain the components of small engine starting systems.*
   a. *Oral/written report to discuss the types of starting systems including rope wide, rope recoil, and electric (AC and DC).*
   b. *Performance Activity - Identify the components of a mechanical starting system and state the function of each including starter housing, recoil spring, pulley, and engaging pawl or dog.*
   c. *Performance Activity - Identify the components of a DC starting system and state the function of each including battery, key switch, starter motor, switch wire, and battery cables.*
2. *Test/service small engine starting systems.*
   a. *Performance Activity - Remove, test/service, and replace a DC starter according to manufacturer's specifications.*
   b. *Performance Activity - Replace a starter rewind spring according to manufacturer's specifications.*
   c. *Performance Activity - Service the vertical pull starter according to manufacturer's specifications.*

Suggested References:

Briggs & Stratton. Service and Repair Instructions for Single Cylinder 4-Cycle Engines. Milwaukee, WI: Author. 1992.

Briggs & Stratton. Service and Repair Instructions for 2-Cycle Engines (Model 95700 and 96700). Milwaukee, WI: Author. 1993.

Deere & Co. Engines, Compact Equipment: Fundamentals of Service (3rd ed.). Moline, IL: Author. 1992.

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Roth, A. C. & Baird, R. J. Small Gas Engines: Workbook. South Holland, IL: Goodheart-Wilcox. 1992.

Schuster, W. A. Small Engine Technology. Albany, NY: Delmar. 1993.

SMALL ENGINE REPAIR II
UNIT 5: EXHAUST SYSTEMS **(10 days)**

Competencies and Suggested Objectives:

1. Explain the functions of small engine exhaust systems.
   a. Define terms associated with exhaust systems including exhaust valve, exhaust pipe, muffler, tail pipe, and exhaust port.
   b. Describe results that can occur from running a damaged or worn exhaust system including loss of power and ring and valve damage.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C6, S6, S8
   Workplace Skills (See Appendix B): WP2, WP4, WP5, WP6
2. Service the muffler system on two- and four-stroke cycle engines.
   a. Remove carbon deposits from exhaust ports and muffler of a two-stroke cycle engine according to manufacturer's specifications.
   b. Replace a muffler on a small engine according to manufacturer's specifications.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C6, S6, S8
   Workplace Skills (See Appendix B): WP2, WP4, WP5, WP6

Suggested Teaching Strategies:

1. *Explain the functions of small engine exhaust systems.*
   a. Discuss terms associated with exhaust systems including exhaust valve, exhaust pipe, muffler, tail pipe, and exhaust port.
   b. Describe results that can occur from running a damaged or worn exhaust system including loss of power and ring and valve damage.
2. *Service the muffler system on two- and four-stroke cycle engines.*
   a. Demonstrate procedures to remove carbon deposits from exhaust ports and muffler of a two-stroke cycle engine according to manufacturer's specifications.
   b. Demonstrate procedures to replace a muffler on a small engine according to manufacturer's specifications.

Suggested Assessment Strategies:

1. *Explain the functions of small engine exhaust systems.*
   a. Test - Define terms associated with exhaust systems including exhaust valve, exhaust pipe, muffler, tail pipe, and exhaust port.
   b. Oral/written report to describe results that can occur from running a damaged or worn exhaust system including loss of power and ring and valve damage.

2. *Service the muffler system on two- and four-stroke cycle engines.*
   a. *Performance Activity - Remove carbon deposits from exhaust ports and muffler of a two-stroke cycle engine according to manufacturer's specifications.*
   b. *Performance Activity - Replace a muffler on a small engine according to manufacturer's specifications.*

Suggested References:

Briggs & Stratton. Service and Repair Instructions for Single Cylinder 4-Cycle Engines. Milwaukee, WI: Author. 1992.

Briggs & Stratton. Service and Repair Instructions for 2-Cycle Engines (Model 95700 and 96700). Milwaukee, WI: Author. 1993.

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Eaddy, V. S. V-TECS Product Elements for Small Engine Repair. Atlanta: Vocational-Technical Education Consortium of the States, in cooperation with Mississippi Department of Education. 1991.

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SMALL ENGINE REPAIR II
UNIT 6: SHOP MANAGEMENT **(10 days)**

Competencies and Suggested Objectives:

1. Apply principles of customer relations in the small engine repair shop.
   a. Communicate with customer and/or supervisor to determine service requested including interpreting and applying oral and written communications.
   b. Complete customer work order form including using the manufacturer's parts manual and the standard work order form to request parts for the engine being repaired and make a formal record to provide accountability of parts used.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M7
   Workplace Skills (See Appendix B): WP1, WP2, WP3, WP4, WP6
2. Apply procedures of shop management in the small engine repair shop.
   a. Utilize parts identification media including parts manuals, microfiche, and computerized parts identification systems.
   b. Maintain work records to account for parts and labor including verification of completed standard work order forms to indicate the major repairs made, parts used, and time taken.
   c. Conduct product liability procedures including maintenance and repairs performed in compliance with manufacturer's product liability guidelines and the American National Standards Institute (ANSI) Standards.
   d. Prepare customer bill/receipt so that the completed product is legible, is free of mathematical error, and accurately reflects the transaction including service performed, parts repaired or replaced, labor, sales tax, and total cost.
   e. Utilize human relations skills in the small engine repair shop to create a pleasant environment and provide customer services with a positive attitude.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M7
   Workplace Skills (See Appendix B): WP1, WP2, WP3, WP4, WP5, WP6

Suggested Teaching Strategies:

1. *Apply principles of customer relations in the small engine repair shop.*
   a. *Discuss how to communicate with customer and/or supervisor to determine service requested including interpreting and applying oral and written communications.*

b. *Demonstrate how to complete customer work order form including using the manufacturer's parts manual and the standard work order form to request parts for the engine being repaired and make a formal record to provide accountability of parts used.*

2. *Apply procedures of shop management in the small engine repair shop.*
   a. *Demonstrate how to utilize parts identification media including parts manuals, microfiche, and computerized parts identification systems.*
   b. *Assist students to maintain work records to account for parts and labor including verification of completed standard work order forms to indicate the major repairs made, parts used, and time taken.*
   c. *Demonstrate how to conduct product liability procedures including maintenance and repairs performed in compliance with manufacturer's product liability guidelines and ANSI Standards.*
   d. *Demonstrate how to prepare customer bill/receipt so that the completed product is legible, is free of mathematical error, and accurately reflects the transaction including service performed, parts repaired or replaced, labor, sales tax, and total cost.*
   e. *Discuss ways to utilize human relations skills in the small engine repair shop to create a pleasant environment and provide customer services with a positive attitude.*

Suggested Assessment Strategies:

1. *Apply principles of customer relations in the small engine repair shop.*
   a. *Performance Activity - Communicate with customer and/or supervisor to determine service requested including interpreting and applying oral and written communications.*
   b. *Performance Activity - Complete customer work order form including using the manufacturer's parts manual and the standard work order form to request parts for the engine being repaired and make a formal record to provide accountability of parts used.*
2. *Apply procedures of shop management in the small engine repair shop.*
   a. *Performance Activity - Utilize parts identification media including parts manuals, microfiche, and computerized parts identification systems.*
   b. *Performance Activity - Maintain work records to account for parts and labor including verification of completed standard work order forms to indicate the major repairs made, parts used, and time taken.*
   c. *Performance Activity - Conduct product liability procedures including maintenance and repairs performed in compliance with manufacturer's product liability guidelines and ANSI Standards.*
   d. *Performance Activity - Prepare customer bill/receipt so that the completed product is legible, is free of mathematical error, and accurately reflects the transaction including service performed, parts repaired or replaced, labor, sales tax, and total cost.*

e. *Performance Activity - Utilize human relations skills in the small engine repair shop to create a pleasant environment and provide customer services with a positive attitude.*

Suggested References:

Briggs & Stratton. Service and Repair Instructions for Single Cylinder 4-Cycle Engines. Milwaukee, WI: Author. 1992.

Briggs & Stratton. Service and Repair Instructions for 2-Cycle Engines (Model 95700 and 96700). Milwaukee, WI: Author. 1993.

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SMALL ENGINE REPAIR II
UNIT 7: EMPLOYABILITY SKILLS **(15 days)**

Competencies and Suggested Objectives:

1. Prepare for employment.
   a. Prepare a resume containing essential information including personal information, education, and employment experience using correct grammar, spelling, and punctuation.
   b. Complete a job application form using correct grammar, spelling, and punctuation.
   c. Explain five procedures for job interviews using correct job etiquette.
   d. Demonstrate the role of an applicant in a job interview using correct interview procedures.
   e. Describe job interview etiquette including behavior, appearance, attire, questioning technique, response to questions, correct English, and knowledge of company products or services.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6
   Workplace Skills (See Appendix B): WP1, WP2, WP3, WP4, WP5, WP6

Suggested Teaching Strategies:

1. *Prepare for employment.*
   a. Demonstrate how to prepare a resume containing essential information including personal information, education, and employment experience using correct grammar, spelling, and punctuation.
   b. Demonstrate how to complete a job application form using correct grammar, spelling, and punctuation.
   c. Explain five procedures for job interviews using correct job etiquette.
   d. Demonstrate the role of an applicant in a job interview using correct interview procedures.
   e. Describe job interview etiquette including behavior, appearance, attire, questioning technique, response to questions, correct English, and knowledge of company products or services.

Suggested Assessment Strategies:

1. *Prepare for employment.*
   a. Assignment - Prepare a resume containing essential information including personal information, education, and employment experience using correct grammar, spelling, and punctuation.

b. *Assignment - Complete a job application form using correct grammar, spelling, and punctuation.*
c. *Assignment - Explain five procedures for job interviews using correct job etiquette.*
d. *Assignment - Demonstrate the role of an applicant in a job interview using correct interview procedures.*
e. *Assignment - Describe job interview etiquette including behavior, appearance, attire, questioning technique, response to questions, correct English, and knowledge of company products or services.*

Suggested References:

Crockett, C., Stevens, S., & Stewart, B. Core Employment Skills. Columbia, MO: Instructional Materials Laboratory. 1990.

Eaddy, V. S. V-TECS Product Elements for Small Engine Repair. Atlanta: Vocational-Technical Education Consortium of the States, in cooperation with Mississippi Department of Education. 1991.

Schulman, M. and Kowaldo, B. F. Working Smart. Cincinatti, OH: South-Western. 1995.

Zedlitz, R. H. Getting a Job. Cincinnati, OH: South-Western. 1993.

SMALL ENGINE REPAIR II
UNIT 8: OVERHAUL OF FOUR-STROKE CYCLE ENGINE (20 days)

Competencies and Suggested Objectives:

1. Describe the parts of a four-stroke cycle engine.
   a. Define terms associated with engine parts and overhaul including piston and connecting rod assembly, valve train, crankshaft assembly, and multi-piece crankshaft.
   b. Explain causes of engine problems including allowing dirt to get into engine, overloading engine, running the engine at excessive rpm, and inadequate lubrication.
   c. Identify parts of a piston and connecting rod assembly including piston head, skirt, pin hole, oil ring groove, connecting rod, retaining ring, piston pin, land, ring side clearance, and rod bearing cap.
   d. Identify parts of the crankshaft assembly including main bearing journals, crankpin, and counterweights.
   e. Identify parts of a valve train including margin, seat, stem, face, retainer, cam, head, valve guide, valve spring, adjusting nut, and tappet guide.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4
   Workplace Skills (See Appendix B): WP1, WP2, WP4, WP5, WP6
2. Inspect and overhaul the four-stroke cycle engine.
   a. Disassemble a four-stroke cycle engine according to manufacturer's specifications.
   b. Inspect and overhaul a cylinder according to manufacturer's specifications.
   c. Inspect and overhaul the piston, rings, and connecting rod according to manufacturer's specifications.
   d. Inspect and overhaul a valve assembly according to manufacturer's specifications.
   e. Reassemble a four-stroke cycle engine according to manufacturer's specifications.
   f. Replace a short block assembly on a four-stroke cycle engine according to manufacturer's specifications.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4
   Workplace Skills (See Appendix B): WP1, WP2, WP4, WP5, WP6

Suggested Teaching Strategies:

1. *Describe the parts of a four-stroke cycle engine.*
   a. *Discuss terms associated with engine parts and overhaul including piston and connecting rod assembly, valve train, crankshaft assembly, and multi-piece crankshaft.*

b. *Demonstrate causes of engine problems including allowing dirt to get into engine, overloading engine, running the engine at excessive rpm, and inadequate lubrication.*
c. *Point out parts of a piston and connecting rod assembly including piston head, skirt, pin hole, oil ring groove, connecting rod, retaining ring, piston pin, land, ring side clearance, and rod bearing cap.*
d. *Point out parts of the crankshaft assembly including main bearing journals, crankpin, and counterweights.*
e. *Point out parts of a valve train including margin, seat, stem, face, retainer, cam, head, valve guide, valve spring, adjusting nut, and tappet guide.*

2. *Inspect and overhaul the four-stroke cycle engine.*
   a. *Demonstrate procedures to disassemble a four-stroke cycle engine according to manufacturer's specifications.*
   b. *Demonstrate procedures to inspect and overhaul a cylinder according to manufacturer's specifications.*
   c. *Demonstrate procedures to inspect and overhaul the piston, rings, and connecting rod according to manufacturer's specifications.*
   d. *Demonstrate procedures to inspect and overhaul a valve assembly according to manufacturer's specifications.*
   e. *Demonstrate procedures to reassemble a four-stroke cycle engine according to manufacturer's specifications.*
   f. *Demonstrate procedures to replace a short block assembly on a four-stroke cycle engine according to manufacturer's specifications.*

Suggested Assessment Strategies:

1. *Describe the parts of a four-stroke cycle engine.*
   a. *Test - Define terms associated with engine parts and overhaul including piston and connecting rod assembly, valve train, crankshaft assembly, and multi-piece crankshaft.*
   b. *Oral/written report to explain causes of engine problems including allowing dirt to get into engine, overloading engine, running the engine at excessive rpm, and inadequate lubrication.*
   c. *Performance Activity - Identify parts of a piston and connecting rod assembly including piston head, skirt, pin hole, oil ring groove, connecting rod, retaining ring, piston pin, land, ring side clearance, and rod bearing cap.*
   d. *Performance Activity - Identify parts of the crankshaft assembly including main bearing journals, crankpin, and counterweights.*
   e. *Performance Activity - Identify parts of a valve train including margin, seat, stem, face, retainer, cam, head, valve guide, valve spring, adjusting nut, and tappet guide.*

2. *Inspect and overhaul the four-stroke cycle engine.*
   a. *Performance Activity - Disassemble a four-stroke cycle engine according to manufacturer's specifications.*
   b. *Performance Activity - Inspect and overhaul a cylinder according to manufacturer's specifications.*
   c. *Performance Activity - Inspect and overhaul the piston, rings, and connecting rod according to manufacturer's specifications.*
   d. *Performance Activity - Inspect and overhaul a valve assembly according to manufacturer's specifications.*
   e. *Performance Activity - Reassemble a four-stroke cycle engine according to manufacturer's specifications.*
   f. *Performance Activity - Replace a short block assembly on a four-stroke cycle engine according to manufacturer's specifications.*

Suggested References:

Briggs & Stratton. Service and Repair Instructions for Single Cylinder 4-Cycle Engines. Milwaukee, WI: Author. 1992.

Briggs & Stratton. Service and Repair Instructions for 2-Cycle Engines (Model 95700 and 96700). Milwaukee, WI: Author. 1993.

Deere & Co. Engines, Compact Equipment: Fundamentals of Service (3rd ed.). Moline, IL: Author. 1992.

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Roth, A. C. & Baird, R. J. Small Gas Engines. South Holland, IL: Goodheart-Wilcox. 1992.

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SMALL ENGINE REPAIR II
UNIT 9: OVERHAUL OF TWO-STROKE CYCLE ENGINE (20 days)

Competencies and Suggested Objectives:

1. Describe the parts of a two-stroke cycle engine.
   a. Explain causes of two-stroke cycle engine problems including incorrect ratio of two-stroke cycle oil mixture, allowing dirt to get in engine, improper engine speed, and overheating.
   b. Identify parts of the piston and connecting rod assembly including land, ring groove, ring groove pin, connecting rod, needle bearings, rod cap, cap screws, and match marks.
   c. Identify parts of the two-cycle crankshaft assembly including main bearing journals, crankpin, connecting rod bearing journal, and counterweights.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4
   Workplace Skills (See Appendix B): WP1, WP2, WP4, WP5, WP6
2. Inspect and overhaul the two-stroke cycle engine.
   a. Disassemble, inspect, and overhaul a two-stroke cycle engine according to manufacturer's specifications.
   b. Reassemble a two-stroke cycle engine according to manufacturer's specifications.
   c. Replace a short block assembly on a two-stroke cycle engine according to manufacturer's specifications.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4
   Workplace Skills (See Appendix B): WP1, WP2, WP4, WP5, WP6

Suggested Teaching Strategies:

1. *Describe the parts of a two-stroke cycle engine.*
   a. *Discuss causes of two-stroke cycle engine problems including incorrect ratio of two-stroke cycle oil mixture, allowing dirt to get in engine, improper engine speed, and overheating.*
   b. *Point out parts of the piston and connecting rod assembly including land, ring groove, ring groove pin, connecting rod, needle bearings, rod cap, cap screws, and match marks.*
   c. *Point out parts of the two-cycle crankshaft assembly including main bearing journals, crankpin, connecting rod bearing journal, and counterweights.*
2. *Inspect and overhaul the two-stroke cycle engine.*
   a. *Demonstrate procedures to disassemble, inspect, and overhaul a two-stroke cycle engine according to manufacturer's specifications.*

b. *Demonstrate procedures to reassemble a two-stroke cycle engine according to manufacturer's specifications.*
c. *Demonstrate procedures to replace a short block assembly on a two-stroke cycle engine according to manufacturer's specifications.*

Suggested Assessment Strategies:

1. *Describe the parts of a two-stroke cycle engine.*
   a. *Test - Explain causes of two-stroke cycle engine problems including incorrect ratio of two-stroke cycle oil mixture, allowing dirt to get in engine, improper engine speed, and overheating.*
   b. *Performance Activity - Identify parts of the piston and connecting rod assembly including land, ring groove, ring groove pin, connecting rod, needle bearings, rod cap, cap screws, and match marks.*
   c. *Performance Activity - Identify parts of the two-cycle crankshaft assembly including main bearing journals, crankpin, connecting rod bearing journal, and counterweights.*
2. *Inspect and overhaul the two-stroke cycle engine.*
   a. *Performance Activity - Disassemble, inspect, and overhaul a two-stroke cycle engine according to manufacturer's specifications.*
   b. *Performance Activity - Reassemble a two-stroke cycle engine according to manufacturer's specifications.*
   c. *Performance Activity - Replace a short block assembly on a two-stroke cycle engine according to manufacturer's specifications.*

Suggested References:

Briggs & Stratton. Service and Repair Instructions for Single Cylinder 4-Cycle Engines. Milwaukee, WI: Author. 1992.

Briggs & Stratton. Service and Repair Instructions for 2-Cycle Engines (Model 95700 and 96700). Milwaukee, WI: Author. 1993.

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SMALL ENGINE REPAIR II
UNIT 10: TROUBLESHOOTING (25 days)

Competencies and Suggested Objectives:

1. Explain the requirements for small engine operation and the basic steps to troubleshooting.
   a. Describe requirements for an engine to run including compression, ignition, and combustion.
   b. Describe, in order, basic troubleshooting procedures including knowing the engine, asking the operator, inspecting the engine, operating the engine if possible, and formulating a conclusion.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, M6, M8
   Workplace Skills (See Appendix B): WP1, WP2, WP4, WP5, WP6
2. Perform troubleshooting procedures on small engine components including fuel, ignition, and compression.
   a. Troubleshoot the fuel system according to manufacturer's specifications.
   b. Troubleshoot the ignition system according to manufacturer's specifications.
   c. Troubleshoot engine compression according to manufacturer's specifications.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, M6, M8
   Workplace Skills (See Appendix B): WP1, WP2, WP4, WP5, WP6

Suggested Teaching Strategies:

1. *Explain the requirements for small engine operation and the basic steps to troubleshooting.*
   a. *Discuss requirements for an engine to run including compression, ignition, and combustion.*
   b. *Demonstrate, in order, basic troubleshooting procedures including knowing the engine, asking the operator, inspecting the engine, operating the engine if possible, and formulating a conclusion.*
2. *Perform troubleshooting procedures on small engine components including fuel, ignition, and compression.*
   a. *Demonstrate procedures to troubleshoot the fuel system according to manufacturer's specifications.*
   b. *Demonstrate procedures to troubleshoot the ignition system according to manufacturer's specifications.*
   c. *Demonstrate procedures to troubleshoot engine compression according to manufacturer's specifications.*

Suggested Assessment Strategies:

1. *Explain the requirements for small engine operation and the basic steps to troubleshooting.*
   a. *Test - Describe requirements for an engine to run including compression, ignition, and combustion.*
   b. *Assignment - Describe, in order, basic troubleshooting procedures including knowing the engine, asking the operator, inspecting the engine, operating the engine if possible, and formulating a conclusion.*
2. *Perform troubleshooting procedures on small engine components, including fuel, ignition, and compression.*
   a. *Performance Activity - Troubleshoot the fuel system according to manufacturer's specifications.*
   b. *Performance Activity - Troubleshoot the ignition system according to manufacturer's specifications.*
   c. *Performance Activity - Troubleshoot engine compression according to manufacturer's specifications.*

Suggested References:

Briggs & Stratton. Service and Repair Instructions for Single Cylinder 4-Cycle Engines. Milwaukee, WI: Author. 1992.

Briggs & Stratton. Service and Repair Instructions for 2-Cycle Engines (Model 95700 and 96700). Milwaukee, WI: Author. 1993.

Deere & Co. Engines, Compact Equipment: Fundamentals of Service (3rd ed.). Moline, IL: Author. 1992.

Eaddy, V. S. V-TECS Product Elements for Small Engine Repair. Atlanta: Vocational-Technical Education Consortium of the States, in cooperation with Mississippi Department of Education. 1991.

Roth, A. C. & Baird, R. J. Small Gas Engines. South Holland, IL: Goodheart-Wilcox. 1992.

Roth, A. C. & Baird, R. J. Small Gas Engines: Workbook. South Holland, IL: Goodheart-Wilcox. 1992.

Schuster, W. A. Small Engine Technology. Albany, NY: Delmar. 1993.

SECTION III:

RECOMMENDED TOOLS AND EQUIPMENT

RECOMMENDED TOOLS AND EQUIPMENT FOR SECONDARY SMALL ENGINE REPAIR

(Quantities for a class of 20 students)

1. Air compressor (1)
2. Brush, wire (5)
3. Cables, battery jumper (1)
4. Caliper (1)
5. Chisel, cold (1)
6. Cleaner, ring groove (5)
7. Compressor, piston ring (5)
8. Compressor, valve spring (5)
9. Computer w/operating software w/multimedia kit (1)
10. Drill, portable (2)
11. Engine, small (4-cycle, 2-5 hp w/horizontal shaft) (5)
12. Engine, small (4-cycle, 2-5 hp w/vertical shaft, overhead valve) (2)
13. Expander, piston ring (2)
14. File set, assorted (5)
15. File, metric thread (1)
16. File, standard thread (1)
17. Flashlight w/gooseneck adapter (2)
18. Gage, breaker plunger (1)
19. Gage, compression (5)
20. Gage, cylinder dial (1)
21. Gage, feeler (5)
22. Gage, plugs (for a given engine) (5)
23. Glaze breaker (1)
24. Grease gun (hand operated, cartridge) (1)
25. Grinder, portable w/wire brush (1)
26. Hacksaw (3)
27. Hammer, ball peen (5)
28. Hammer, brass (5)
29. Holder, flywheel (5)
30. Hone, cylinder (midget) (1)
31. Impact tool, set (1)
32. Key, metric hex (1)
33. Lamp, 12 V test (1)
34. Light, timing (1)
35. Light, trouble (2)
36. Magnet, w/handle (1)
37. Micrometer, assorted sizes (1@)
38. Multimeter (digital,VOM) (3)
39. Nut driver, set (1)

40. Nut cracker (1)
41. Pilot set (for a given engine) (1)
42. Pliers, assorted (5)
43. Pliers, retaining ring (convertible type) (2)
44. Pliers, vise grip (5)
45. Press, arbor (1)
46. Printer, dot matrix (1)
47. Puller set, bearing (1)
48. Puller, flywheel (5)
49. Punch set, metal (assorted) (1)
50. Reamer set (for a given engine) (5)
51. Reamer, ridge (1)
52. Rule, steel (2)
53. Scraper, gasket (5)
54. Screw extractor set (1)
55. Screwdriver set (assorted, flat blade) (5)
56. Screwdriver set (assorted, Phillips) (5)
57. Screwdriver set, carburetor jet (small) (2@ in set) (5)
58. Soldering iron (1)
59. Sprocket tool (1)
60. Stand, small engine (5)
61. Starter, rewind crank (1)
62. Stud remover (1)
63. Tachometer, vibrator type (5)
64. Tap and die set, SAE (1)
65. Tap and die set, metric (1)
66. Terminal lifters, battery (1)
67. Terminal cleaner, battery (2)
68. Tester, c.d. ignition (1)
69. Tester, diode (1)
70. Tester, ignition (M-80) (1)
71. Tester, spark (5)
72. Tester, coil and condenser (5)
73. Tool, tubing (1)
74. Valve grinding machine (wet valve for small engine) (1)
75. Valve seat repair set (for a given engine) (1)
76. Vice, swivel base (5)
77. Washer, parts (1)
78. Welder, oxyaceteylene (1)
79. Wrench, air impact (1/2") (1)
80. Wrench, adjustable (5)
81. Wrench, clutch (5)
82. Wrench, ignition (5)
83. Wrench set, Allen (5)

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84. Wrench set, combination (5)
85. Wrench set, socket, 1/4" drive (5)
86. Wrench set, socket, 3/8" drive (5)
87. Wrench set, socket, 1/2" drive (2)
88. Wrench, spark plug (5)
89. Wrench, torque (foot/lbs.) (5)
90. Wrench, torque (inch/lbs.) (5)

RECOMMENDED INSTRUCTIONAL AIDS

1. Calculator (1)
2. Cart, AV (for overhead projector) (1)
3. Cart, AV (For TV-VCR) (1)
4. Projector, overhead (1)
5. Software for parts identification and cost estimation in Small Engine Repair
6. TV-VCR (1)
7. Video out (Microcomputer to TV monitor) (1)

APPENDIX A:

RELATED ACADEMIC TOPICS

APPENDIX A

RELATED ACADEMIC TOPICS FOR COMMUNICATIONS

C1 Interpret written material.
C2 Interpret visual materials (maps, charts, graphs, tables, etc.).
C3 Listen, comprehend, and take appropriate actions.
C4 Access, organize, and evaluate information.
C5 Use written and/or oral language skills to work cooperatively to solve problems, make decisions, take actions, and reach agreement.
C6 Communicate ideas and information effectively using various oral and written forms for a variety of audiences and purposes.

EXPANDED TOPICS FOR COMMUNICATIONS

TOPIC C1: Interpret written material.

C1.01 Read and follow complex written directions.
C1.02 Recognize common words and meanings associated with a variety of occupations.
C1.03 Adjust reading strategy to purpose and type of reading.
C1.04 Use sections of books and reference sources to obtain information.
C1.05 Compare information from multiple sources and check validity.
C1.06 Interpret items and abbreviations used in multiple forms.
C1.07 Interpret short notes, memos, and letters.
C1.08 Comprehend technical words and concepts.
C1.09 Use various reading techniques depending on purpose for reading.
C1.10 Find, read, understand, and use information from printed matter or electronic sources.

TOPIC C2: Interpret visual materials (maps, charts, graphs, tables, etc.).

C2.01 Use visuals in written and in oral presentations.
C2.02 Recognize visual cues to meaning (layout, typography, etc.).
C2.03 Interpret and apply information using visual materials.

TOPIC C3: Listen, comprehend, and take appropriate action.

C3.01 Identify and evaluate orally-presented messages according to purpose.
C3.02 Recognize barriers to effective listening.
C3.03 Recognize how voice inflection changes meaning.
C3.04 Identify speaker signals requiring a response and respond accordingly.
C3.05 Listen attentively and take accurate notes.
C3.06 Use telephone to receive information.

C3.07 Analyze and distinguish information from formal and informal oral presentations.

TOPIC C4: Access, organize, and evaluate information.

C4.01 Distinguish fact from opinion.
C4.02 Use various print and non-print sources for specialized information.
C4.03 Interpret and distinguish between literal and figurative meaning.
C4.04 Interpret written or oral communication in relation to context and writer's point of view.
C4.05 Use relevant sources to gather information for written or oral communication.

TOPIC C5: Use written and/or oral language skills to work cooperatively to solve problems, make decisions, take actions, and reach agreement.

C5.01 Select appropriate words for communication needs.
C5.02 Use reading, writing, listening, and speaking skills to solve problems.
C5.03 Compose inquiries and requests.
C5.04 Write persuasive letters and memos.
C5.05 Edit written reports, letters, memos, and short notes for clarity, correct grammar, and effective sentences.
C5.06 Write logical and understandable statements, phrases, or sentences for filling out forms, for correspondence or reports.
C5.07 Write directions or summaries of processes, mechanisms, events, or concepts.
C5.08 Select and use appropriate formats for presenting reports.
C5.09 Convey information to audiences in writing.
C5.10 Compose technical reports and correspondence that meet accepted standards for written communications.

TOPIC C6: Communicate ideas and information using oral and written forms for a variety of audiences and purposes.

C6.01 Give complex oral instructions.
C6.02 Describe a business or industrial process/mechanism.
C6.03 Participate effectively in group discussions and decision making.
C6.04 Produce effective oral messages utilizing different media.
C6.05 Explore ideas orally with partners.
C6.06 Participate in conversations by volunteering information when appropriate and asking relevant questions when appropriate.
C6.07 Restate or paraphrase a conversation to confirm one's own understanding.
C6.08 Gather and provide information utilizing different media.

C6.09 Prepare and deliver persuasive, descriptive, and demonstrative oral presentations.

RELATED ACADEMIC TOPICS FOR MATHEMATICS

M1 Relate number relationships, number systems, and number theory.
M2 Explore patterns and functions.
M3 Explore algebraic concepts and processes.
M4 Explore the concepts of measurement.
M5 Explore the geometry of one-, two-, and three-dimensions.
M6 Explore concepts of statistics and probability in real world situations.
M7 Apply mathematical methods, concepts, and properties to solve a variety of real-world problems.

EXPANDED TOPICS FOR MATHEMATICS

TOPIC M1: Relate number relationships, number systems, and number theory.

M1.01 Understand, represent, and use numbers in a variety of equivalent forms (integer, fraction, decimal, percent, exponential, and scientific notation) in real world and mathematical problem situations.
M1.02 Develop number sense for whole numbers, fractions, decimals, integers, and rational numbers.
M1.03 Understand and apply ratios, proportions, and percents in a wide variety of situations.
M1.04 Investigate relationships among fractions, decimals, and percents.
M1.05 Compute with whole numbers, fractions, decimals, integers, and rational numbers.
M1.06 Develop, analyze, and explain procedures for computation and techniques for estimations.
M1.07 Select and use an appropriate method for computing from among mental arithmetic, paper-and-pencil, calculator, and computer methods.
M1.08 Use computation, estimation, and proportions to solve problems.
M1.09 Use estimation to check the reasonableness of results.

TOPIC M2: Explore patterns and functions.

M2.01 Describe, extend, analyze, and create a wide variety of patterns.
M2.02 Describe and represent relationships with tables, graphs, and rules.
M2.03 Analyze functional relationships to explain how a change in one quantity results in a change in another.
M2.04 Use patterns and functions to represent and solve problems.
M2.05 Explore problems and describe results using graphical, numerical, physical, algebraic, and verbal mathematical models or representations.

M2.06 Use a mathematical idea to further their understanding of other mathematical ideas.
M2.07 Apply mathematical thinking and modeling to solve problems that arise in other disciplines, such as art, music, and business.

TOPIC M3: Explore algebraic concepts and processes.

M3.01 Represent situations and explore the interrelationships of number patterns with tables, graphs, verbal rules, and equations.
M3.02 Analyze tables and graphs to identify properties and relationships and to interpret expressions and equations.
M3.03 Apply algebraic methods to solve a variety of real world and mathematical problems.

TOPIC M4: Explore the concepts of measurement.

M4.01 Estimate, make, and use measurements to describe and compare phenomena.
M4.02 Select appropriate units and tools to measure to the degree of accuracy required in a particular situation.
M4.03 Extend understanding of the concepts of perimeter, area, volume, angle measure, capacity, and weight and mass.
M4.04 Understand and apply reasoning processes, with special attention to spatial reasoning and reasoning with proportions and graphs.

TOPIC M5: Explore the geometry of one-, two-, and three-dimensions.

M5.01 Identify, describe, compare, and classify geometric figures.
M5.02 Visualize and represent geometric figures with special attention to developing spatial sense.
M5.03 Explore transformations of geometric figures.
M5.04 Understand and apply geometric properties and relationships.
M5.05 Classify figures in terms of congruence and similarity and apply these relationships.

TOPIC M6: Explore the concepts of statistics and probability in real world situations.

M6.01 Systematically collect, organize, and describe data.
M6.02 Construct, read, and interpret tables, charts, and graphs.
M6.03 Develop an appreciation for statistical methods as powerful means for decision making.
M6.04 Make predictions that are based on exponential or theoretical probabilities.

M6.05 Develop an appreciation for the pervasive use of probability in the real world.

TOPIC M7: Apply mathematical methods, concepts, and properties to solve a variety of real-world problems.

M7.01 Use computers and/or calculators to process information for all mathematical situations.
M7.02 Use problem-solving approaches to investigate and understand mathematical content.
M7.03 Formulate problems from situations within and outside mathematics.
M7.04 Generalize solutions and strategies to new problem situations.

RELATED ACADEMIC TOPICS FOR SCIENCE

S1 Explain the Anatomy and Physiology of the human body.
S2 Apply the basic biological principles of Plants, Viruses and Monerans, Algae, Protista, and Fungi.
S3 Relate the nine major phyla of the kingdom animalia according to morphology, anatomy, and physiology.
S4 Explore the chemical and physical properties of the earth to include Geology, Meteorology, Oceanography, and the Hydrologic Cycle.
S5 Investigate the properties and reactions of matter to include symbols, formulas and nomenclature, chemical equations, gas laws, chemical bonding, acid-base reactions, equilibrium, oxidation-reduction, nuclear chemistry, and organic chemistry.
S6 Explore the principles and theories related to motion, mechanics, electricity, magnetism, light energy, thermal energy, wave energy, and nuclear physics.
S7 Explore the principles of genetic and molecular Biology to include the relationship between traits and patterns of inheritance, population genetics, the structure and function of DNA, and current applications of DNA technology.
S8 Apply concepts related to the scientific process and method to include safety procedures for classroom and laboratory; use and care of scientific equipment; interrelationships between science, technology and society; and effective communication of scientific results in oral, written, and graphic form.

EXPANDED TOPICS FOR SCIENCE

TOPIC S1: Explain the Anatomy and Physiology of the human body.

S1.01 Recognize common terminology and meanings.
S1.02 Explore the relationship of the cell to more complex systems within the body.

S1.03 Summarize the functional anatomy of all the major body systems.
S1.04 Relate the physiology of the major body systems to its corresponding anatomy.
S1.05 Compare and contrast disease transmission and treatment within each organ system.
S1.06 Explore the usage of medical technology as related to human organs and organ systems.
S1.07 Explain the chemical composition of body tissue.

TOPIC S2: Apply the basic biological principles of Plants, Viruses and Monerans, Algae, Protista, and Fungi.

S2.01 Identify the major types and structures of plants, viruses, monera, algae protista, and fungi.
S2.02 Explain sexual and asexual reproduction.
S2.03 Describe the ecological importance of plants as related to the environment.
S2.04 Analyze the physical chemical and behavioral process of a plant.

TOPIC S3: Relate the nine major phyla of the kingdom animalia according to morphology, anatomy, and physiology.

S3.01 Explain the morphology, anatomy, and physiology of animals.
S3.02 Describe the characteristics, behaviors, and habitats of selected animals.

TOPIC S4: Explore the chemical and physical properties of the earth to include Geology, Meteorology, Oceanography, and the Hydrologic Cycle.

S4.01 Examine minerals and their identification, products of the rock cycle, byproducts of weathering, and the effects of erosion.
S4.02 Relate the Hydrologic Cycle to include groundwater its zones, movement, and composition; surface water systems, deposits, and runoff.
S4.03 Consider the effects of weather and climate on the environment.
S4.04 Examine the composition of seawater; wave, tides, and currents; organisms, environment, and production of food; energy, food and mineral resources of the oceans.

TOPIC S5: Investigate the properties and reactions of matter to include symbols, formulas and nomenclature, chemical equations, gas laws, chemical bonding, acid-base reactions, equilibrium, oxidation-reduction, nuclear chemistry, and organic chemistry.

S5.01 Examine the science of chemistry to include the nature of matter, symbols, formulas and nomenclature, and chemical equations.

S5.02 Identify chemical reactions including precipitation, acids-bases, and reduction-oxidation.
S5.03 Explore the fundamentals of chemical bonding and principles of equilibrium.
S5.04 Relate the behavior of gases.
S5.05 Investigate the structure, reactions, and uses of organic compounds; and investigate nuclear chemistry and radiochemistry.

TOPIC S6: Explore the principles and theories related to motion, mechanics, electricity, magnetism, light energy, thermal energy, wave energy, and nuclear physics.

S6.01 Examine fundamentals of motion of physical bodies and physical dynamics.
S6.02 Explore the concepts and relationships among work, power, and energy.
S6.03 Explore principles, characteristics, and properties of electricity, magnetism, light energy, thermal energy, and wave energy.
S6.04 Identify principles of modern physics related to nuclear physics.

TOPIC S7: Explore the principles of genetic and molecular Biology to include the relationship between traits and patterns of inheritance; population genetics, the structure and function of DNA, and current applications of DNA technology.

S7.01 Examine principles, techniques, and patterns of traits and inheritance in organisms.
S7.02 Apply the concept of population genetics to both microbial and multicellular organism.
S7.03 Identify the structure and function of DNA and the uses of DNA technology in science, industry, and society.

TOPIC S8: Apply concepts related to the scientific process and method to include safety procedures for classroom and laboratory; use and care of scientific equipment; interrelationships between science, technology and society; and effective communication of scientific results in oral, written, and graphic form.

S8.01 Apply the components of scientific processes and methods in classroom and laboratory investigations.
S8.02 Observe and practice safe procedures in the classroom and laboratory.
S8.03 Demonstrate proper use and care for scientific equipment.
S8.04 Investigate science careers, and advances in technology.
S8.05 Communicate results of scientific investigations in oral, written, and graphic form.

APPENDIX B:

WORKPLACE SKILLS

APPENDIX B
WORKPLACE SKILLS FOR THE 21ST CENTURY

WP1 Allocates resources (time, money, materials and facilities, and human resources).

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.

WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.

WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.

WP5 Selects, applies, and maintains/troubleshoots technology.

WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.

APPENDIX C:

STUDENT COMPETENCY PROFILE

STUDENT COMPETENCY PROFILE FOR SMALL ENGINE REPAIR I

Student: _____

This record is intended to serve as a method of noting student achievement of the competencies in each course. It can be duplicated for each student and serve as a cumulative record of competencies achieved in the program.

In the blank before each competency, place the date on which the student mastered the competency.

Unit 1: Safety and Orientation

_____ 1. Explain vocational policies, procedures, and requirements.
_____ 2. Apply safety laws and standards used in small engine repair.
_____ 3. Explain procedures for working with and disposing of hazardous materials according to OSHA regulations.

Unit 2: Tools and Equipment

_____ 1. Explain the application and use of hand tools.
_____ 2. Explain the safe use of power tools and equipment.

Unit 3: Fasteners

_____ 1. Explain common fasteners, tools, and procedures for restoring damaged threads.

Unit 4: Measurement

_____ 1. Apply measurement procedures used in small engine repair.

Unit 5: Engine Identification and Inspection

_____ 1. Identify types of small engines.

Unit 6: Basic Engine Principles and Design

_____ 1. Explain the principles of operation of an internal combustion engine.
_____ 2. Analyze engine horsepower rating.
_____ 3. Explain the principles of four-stroke cycle engine operation.
_____ 4. Explain the principles of two-stroke cycle engine operation.

Unit 7: Basic Electricity

_____ 1. Explain the principles of basic electricity.
_____ 2. Describe instruments and perform measurements of electricity.

Unit 8: Ignition Systems

_____ 1. Explain the components of a small engine ignition system.
_____ 2. Service and test small engine ignition systems.

Unit 9: Lubrication Systems

_____ 1. Explain the principles of lubrication and engine oils.
_____ 2. Perform lubrication services on small engines.
_____ 3. Apply procedures for preparing a small engine for storage.

Unit 10: Cooling Systems

_____ 1. Service an air-cooled small engine system.
_____ 2. Service a water-cooled small engine system.

Unit 11: Fuel Systems (Carburetor-Type)

_____ 1. Identify fuel and fuel systems used in small engines.
_____ 2. Remove, service, replace, and adjust an air cleaner, oil bath cleaner, float-type carburetor, and diaphragm-type carburetor.

STUDENT COMPETENCY PROFILE FOR SMALL ENGINE REPAIR II

Student: _____

This record is intended to serve as a method of noting student achievement of the competencies in each course. It can be duplicated for each student and serve as a cumulative record of competencies achieved in the program.

In the blank before each competency, place the date on which the student mastered the competency.

Unit 1: Safety and Orientation (Review and Reinforcement)

_____ 1. Explain vocational policies, procedures, and requirements.
_____ 2. Apply safety laws and standards used in small engine repair.
_____ 3. Explain procedures for working with and disposing of hazardous materials according to OSHA regulations.

Unit 2: Charging Systems

_____ 1. Explain the components of small engine charging systems.
_____ 2. Service a small engine charging system.

Unit 3: Governor Systems

_____ 1. Explain governor systems used in small engines.
_____ 2. Inspect, adjust, and repair small engine governor systems.

Unit 4: Starting Systems

_____ 1. Explain the components of small engine starting systems.
_____ 2. Test/service small engine starting systems.

Unit 5: Exhaust Systems

_____ 1. Explain the functions of small engine exhaust systems.
_____ 2. Service the muffler system on two- and four-stroke cycle engines.

Unit 6: Shop Management

_____ 1. Apply principles of customer relations in the small engine repair shop.
_____ 2. Apply procedures of shop management in the small engine repair shop.

Unit 7: Employability Skills

_____ 1. Prepare for employment.

Unit 8: Overhaul of Four-Stroke Cycle Engine

_____ 1. Describe the parts of a four-stroke cycle engine.
_____ 2. Inspect and overhaul the four-stroke cycle engine.

Unit 9: Overhaul of Two-Stroke Cycle Engine

_____ 1. Describe the parts of a two-stroke cycle engine.
_____ 2. Inspect and overhaul the two-stroke cycle engine.

Unit 10: Troubleshooting

_____ 1. Explain the requirements for small engine operation and the basic steps to troubleshooting.
_____ 2. Perform troubleshooting procedures on small engine components including fuel, ignition, and compression.